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REPORT

ON THE

DRAINAGE

OF THE CITY OF

NEW ORLEANS,

1895.

Compliments of

L. W. Brown,

City Engineer.

REPORT

ON THE

Drainage of the City of New Orleans,

BY THE

ADVISORY BOARD,

APPOINTED BY ORDINANCE No. 8327, ADOPTED BY THE CITY COUNCIL, NOVEMBER 24, 1893.

Members of Board:

HON. JOHN FITZPATRICK, Ex Officio Chairman.
R. M. WALMSLEY, Esq., Chairman.
J. C. DENIS, Esq.
A. BALDWIN, Esq.
B. M. HARROD, C. E.
HENRY B. RICHARDSON, C. E.
RUDOLPH HERING, C. E.

Engineering Committee:

B. M. HARROD, Chairman, New Orleans.
HENRY B. RICHARDSON, New Orleans.
RUDOLPH HERING, New York.

City Engineer:

L. W. BROWN.

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NEW ORLEANS, April 29, 1895.

To the Honorable, the Mayor and Council

Of the City of New Orleans:

GENTLEMEN:

The Advisory Board on Drainage of the City of New Orleans, appointed by Ordinance No. 8327, C. S., dated November 24th, 1893, have the honor to forward, with its approval, a plan for the drainage of the City of New Orleans. The commencement of work, as soon as practicable, is recommended.

We desire to recognize the efficient services of Mr. L. W. Brown, City Engineer, and also, of the members of the engineering corps assisting him in the work, both in the field and office.

We further recommend the continuation of the rain-fall record and of the run-off observations.

Respectfully submitted,

R. M. WALMSLEY, Chairman,
J. C. DENIS,
ALBERT BALDWIN,
B. M. HARROD,
HENRY B. RICHARDSON,
RUDOLPH HERING,
Advisory Board.

PART I.

INTRODUCTION.

To the Advisory Board on Drainage of the City of New Orleans,

GENTLEMEN:—The undersigned Engineering Committee, appointed by you on December 14th, 1893, have the honor to present the following final report concerning their investigations into the subject of the drainage of the City of New Orleans, as well as their approval of a certain plan therefor, as authorized by Ordinance No. 8327, C. S., adopted November 24th, 1893.

The first steps leading up to this report were, taken by the City Council of the City of New Orleans, by the passage of Ordinance No. 7170, C. S., adopted February 6th, 1893, an ordinance providing for the making of a topographical survey; and formulating a complete and comprehensive system of drainage for the City of New Orleans, and authorizing the making of the necessary investigations, of which the following is a copy:

First steps towards topographical survey.

No. 7170, Council Series.

MAYORALTY OF NEW ORLEANS,
City Hall, Feb. 6, 1893.

WHEREAS, The drainage of the City of New Orleans, is in an extraordinary disastrous condition, and, Whereas, There is no uniform or general plan adopted for the drainage of the city, and, Whereas, Large sums of money have been spent from time to time without any general system or plan of drainage being adopted, and, Whereas, Were a general and comprehensive system adopted, such money as is spent from time to time on drainage could be spent in such a manner as to further the completion of a complete system, and, Whereas, There is no positive or correct data as to the topography of the city, and, Whereas, It is absolutely necessary in order to formulate a thorough and comprehensive plan of drainage, for the engineers to have exact, precise and full information relative to the topography of the city, the conditions of the soil as to absorption, and other data pertinent to the subject.

Be it ordained by the Common Council of the City of New Orleans, That by and with the approval of the Board of Liquidation, the sum of seventeen thousand, five hundred dollars, ($17,500) from that portion of the surplus in the hands of said Board, which, by Section 10 of Article 110 of the Acts of the Legislature of 1890, is dedicated for public improvements, be and is hereby appropriated for the making of a thorough and complete topographical survey of the City of New Orleans and to obtain all the necessary data requisite for the formulating of a complete plan of drainage.

Be it further ordained, etc., That, immediately the information is obtained, the City Engineer will prepare and submit to the Council of the City of New Orleans a complete and comprehensive plan with sufficient

detail to enable the plan to be thoroughly understood, and in such form as to designate the manner in which the work can be executed by degrees as money may be appropriated from time to time for the purpose of drainage, so that such money as is spent will be towards the ultimate completion of the complete plan.

Be it further ordained, etc., That the City Engineer, in conjunction with the Mayor and chairman of the committee on Water and Drainage, shall have authority to call, if necessary, an advisory board of expert engineers on drainage for the purpose of confirming by competent authority such plan as may be adopted.

Be it further ordained, etc., That the City Engineer shall confer with the Mayor as to the expenditures, and will report every two weeks to the Council of the City of New Orleans, of the progress of the work and expenses of same.

Adopted by the Council of the City of New Orleans, January 31, 1893.

DAN. A. ROSE, Clerk of Council.

Approved February 6, 1893.

JOHN FITZPATRICK, Mayor.

A true copy:
CLARK STEEN, Secretary to the Mayor.

Advisory Engineers.

When the work was inaugurated, Messrs. Rudolph Hering, B. M. Harrod and H. B. Richardson, were appointed an "Advisory Board of Engineers," under the provisions of Ordinance No. 7350, C. S., adopted March 30th, 1893, which ordinance reads as follows:

No. 7350 Council Series.

MAYORALTY OF NEW ORLEANS,
City Hall, March 30, 1893.

BE IT ORDAINED by the Common Council of the City of New Orleans, That Section 3 of Ordinance No. 7170, adopted February 6, 1893, be amended so as to read as follows: "Be it further ordained, etc., That the Mayor shall appoint three (3) competent engineers to form an advisory board of engineers, for the purpose of approving or disapproving of the plan proposed by the City Engineer for the making of the topographical survey of the City of New Orleans, and obtaining information necessary for the formulating of a plan of drainage, as also to thoroughly investigate and pass upon such plan of drainage as may be submitted to the City Council for approval, the compensation of this board of expert engineers to be paid out of the fund provided for in this ordinance, which compensation is to be fixed by the Mayor, the chairman of the water and drainage committee, and the chairman of the finance committee of the City Council."

Adopted by the Council of the City of New Orleans, March 28, 1893.

DAN. A. ROSE, Clerk of Council.

Approved March 30, 1893.

A true copy: JOHN FITZPATRICK, Mayor.
CLARK STEEN, Secretary to the Mayor.

Subsequently, the present organization of the Advisory Board was created by Ordinance No. 8327, C. S., which Ordinance reads as follows:

No. 8327 Council Series.

MAYORALTY OF NEW ORLEANS,
City Hall, Nov. 24, 1893.

WHEREAS, This, the Common Council of the City of New Orleans has pledged itself to do all in its power for the effective drainage of the City of New Orleans; and whereas, the most available funds for this purpose, in which all are so greatly interested are derived chiefly from the sales of fran-

chises: Be it resolved, That the sum of seven hundred thousand (700,000) dollars, derived from the sale of the franchise of the city railroads acquired by Henry Bier, be and the same is hereby created a sacred fund to be devoted exclusively and solely for drainage purposes. Be it further resolved, That the plans for the preliminary topographical survey, if the hereinafter advisory board should deem the same necessary as well as any plans of survey or plans of drainage offered by civil engineers or other parties, shall be submitted to the advisory board, to be composed of Mr. H. B. Richardson, present Chief State Engineer, Major B. M. Harrod, Mr. Rudolph Hering, Mr. R. M. Walmsley, Mr. J. C. Denis, and Mr. Edward Fenner, for approval or recommendation by said board to the City Council; provided, that no plan of drainage shall be finally adopted by the said advisory board, unless it receives the approval of a majority of the aforesaid City Council. In case of the death of any member of the advisory board herein named, the other members shall select another person to act with them. Be it further resolved, That the Clerk of the Council is hereby instructed to send a notice to the members of the aforesaid advisory board of the meetings of the committee on drainage, in order that said members may be advised and enabled to be present at said meetings.

Adopted by the Council of the City of New Orleans, November 21, 1893.

DAN. A. ROSE, Clerk of Council.

Approved November 24, 1893.

A true copy: JOHN FITZPATRICK, Mayor.

CLARK STEEN, Secretary to the Mayor.

NOTE:—Mr. Albert Baldwin was elected a member of the board, vice Mr. Edward Fenner, resigned.

History.

In order to inform themselves of the nature and merits of the various plans that, had been proposed from time to time, relative to the drainage of the city, inquiry was made into the history of the subject; an account of which will be found in Appendix II.

Public meetings of board.

To further learn the views of civil engineers, and others who had plans to present, or were otherwise interested in the subject of draining the city, several public meetings were held, and the information obtained from those gentlemen who appeared before the Board was afterward carefully considered.

The first of the public meetings of the Advisory Board, after due advertisement, was held in the Council Chamber December 14th, 1893, and was addressed by Mr. S. D. Peters, Mr. Geo. H. Grandjean and Hon. Chas. Louque.

At the adjourned meeting on December 15th, Mr. S. D. Peters appeared, and thoroughly explained his plans.

On February 19th, 1894, the late Mr. J. L. Gubernator appeared before the committee and explained his plan relative to the drainage of the city.

A final public meeting was held, after due advertisement, in the Council Chamber, on February 15th, 1895, and was addressed by Mr. A. F. Wrotnowski, C. E., Mr. G. H. Grandjean, C. E., Mr. A. C. Bell, C. E., Mr. S. D. Peters, and Hon. Charles Louque.

Instructions to City Engineer relative to data.

In order to enable your committee to form a safe judgment upon the merits of proposed plans, an inquiry had first to be made regarding all existing information relating to the subject. It was found that some of the essential factors for this judgment were not available. Your committee, at a meeting on May 2d, 1893 (then, acting as a

Board of Advisory Engineers), issued to the City Engineer, Mr. L. W. Brown, the necessary instructions relative to the investigations which were to be made, for the purpose of collecting the data that were absolutely required to properly solve the problem before them. In conformity with these directions, the City Engineer secured the necessary instruments, etc., so that actual work on the topographical survey was begun about the first of July, 1893, after which it proceeded uninterruptedly until about the first of September, 1893, when, by injunction issued by the Civil District Court, the work was stopped. After the removal of the injunction, work was resumed about the middle of December, 1893, and continued until the present time.

Progress of survey.

Suspension and resumption of work.

With the light thus furnished, your committee thoroughly and carefully examined into the plans submitted at the public meetings, and those which were otherwise available. They found that, while the authors had shown much industry in formulating their plans, they were not based on reliable topographical and hydrographical data, and, while they contained some useful suggestions, no one of them could be recommended as a whole by your committee. None of the plans, provided with sufficient definiteness for a suitable and permanent improvement of the existing conditions of drainage in the commercial and resident portion of the city, which was deemed by your committee to be a most important part of a drainage plan. It, therefore, devolved upon the City Engineer, Mr. L. W. Brown, to make, with the funds available for the purpose, all necessary computations and plans, and to base them upon the results obtained by the preliminary work that had been done by him, as well as upon all the other information furnished by previous plans and suggestions which were at his disposal. Step by step this work was carefully examined and approved by your committee, which had made itself thoroughly familiar with the territory, its needs, and the propositions for its improvement, and now approves the work as a whole.

Investigation of plans.

Formulation of data by City Engineer.

Approval of work done by City Engineer

In the following, this plan is described in its general features, and a suggestion submitted for the manner of prosecuting the work, and a statement of its approximate cost. In order to justify a recommendation of the plan, it is desirable to precede the description by a statement of the general requirements thereof, to satisfy all the important demands and to solve the drainage problem, not only for the present but also for the future, and by a statement of the essential factors that are necessary for such a solution.

General features of report.

PART II.

STATEMENT OF GENERAL REQUIREMENTS.

Broad View.

An investigation into the principal features and outlines of a drainage system for the City of New Orleans should be made with a view of realizing the inevitable growth and development of the city, and the increasing demands which, at the present time, sanitation, comfort and economy make upon every large modern community.

Previous work of drainage and result.

In the past it was deemed sufficient to adopt makeshifts, one after another, to accomplish some immediate ends and to benefit small disconnected sections. The result has naturally been: a somewhat incoherent and crude system of drains and canals, insufficient in size, depth and slope; a disposal of the water which, regarding its main channels and outfalls, is becoming more and more objectionable; and methods of pumping which are both inefficient and uneconomical.

Reasons for adopting broad views.

It has now become clear not only that the city will steadily advance in size and importance, but that means will become available, in proportion to its growth, to better the streets, the railway service, the lighting and water supply, the pavements, the sewerage and also the drainage. Any material improvements of the city that are now instituted, should no longer be temporary expedients, but based upon well digested plans designed to provide for all future contingencies, so far as these can be safely estimated.

Effect of Sewage.

The recent establishment of a sewerage system, which is to remove from the buildings to a proper outfall, all foul waste matters that can be carried away in suspension by flowing water, has in some degree affected the drainage question by removing from consideration an element that would have caused a material modification of the problem.

Existing conditions.

The drainage question of this city to-day, therefore applies principally to the removal of the rain water falling upon the inhabited and built-up part of the city, which does not penetrate the ground, but runs off into the gutters, and then floods the streets and finally the low territory, causing more or less damage to property and interfering with travel and the transaction of business. It applies likewise to the removal of the ground water which at present saturates the soil, causing unsanitary conditions, besides preventing the usefulness of the territory, for one or another purpose as may be required in a large city.

Many blocks in the city which are not now built up because they are practically swamps, although within convenient distance of the business center, will likewise be benefited by efficient drainage.

A drainage project should therefore be extended to all territory which is now, or will be, built up in a reasonable time, and it should effect the removal of rain and ground water from the same, so that the whole area can be made and kept thoroughly dry. This area has been limited for the present purpose as follows, viz: On the left bank of the Mississippi River, of the territory embraced by the Upper Protection Levee, Lake Pontchartrain, People's Avenue Canal, Florida Avenue and the lower limits of the city; and on the right bank of the Mississippi

Territory to be embraced in a drainage plan.

River, the line between the parishes of Orleans and Jefferson, the lower side of the naval reservation and rear protection levee, all as shown on Plate IV.

Features to be considered

The lowness of the land requires all of the rain and ground water, to be lifted by pumps, before it can be finally disposed of. As the area is one of great magnitude, the required pumping capacity will be considerable, and it becomes necessary to adopt such methods of collecting and conveying the water, as will enable the most economical pumps and arrangements to be used. It also becomes a matter of moment to ascertain the most economical lines, sizes, depths and slopes of the canals to facilitate such removal in the most efficient way.

Features governing final disposal.

A further important requirement of a drainage plan is the final proper disposition of the water. Since, in the near future, most of the sewage will be separated from the drainage water, it is to be assumed that the latter will soon be much improved in quality, although still containing street washings and leachings from the soil. The storm water from heavy showers is less objectionable in quality. The high dilution of the organic matter will render it inoffensive and harmless, notwithstanding the water may be more turbid from a larger amount of suspended earthy matter that is contained in it.

The question of disposal must be answered in the light of these two conditions of the water. Its ordinary flow should not be delivered where even its slight pollution would be undesirable or detrimental to the value of adjoining lands. It should if possible be discharged at points where no considerable development is expected.

Street washing.

The first flow from a storm generally carries with it the washings from the streets and houses, and is also to a certain degree polluted. It is therefore advisable to treat it like the ordinary flow. The water from heavy rain-falls, however, so largely dilutes the waters just mentioned, that it can be considered quite unobjectionable, at least from a sanitary point of view, and discharged at the nearest available points into any natural water course or lake. As it may sometimes gather up and carry along considerable quantities of silt, due to its greater velocity, care must be taken that no detriment to the canals results therefrom.

Navigation canals.

The final requirement is the maintenance of the two existing navigation canals to best subserve the demands of commerce. It has been suggested, and with some good reason, that the river end of these canals as far as Broad street might be abandoned for navigation and made available for drainage, but on the lake side of Broad street they should be preserved and kept free from surface water, on account of resulting deposits.

Plan must provide for

Any plan satisfying all of the above-mentioned demands must necessarily be comprehensive: it must cover a large and now mostly uninhabited territory, and a long time will be required to execute the same. As some of the demands are now urgent, and should be satisfied as soon as practicable, the plan should therefore allow of the possibility of at once carrying out some portions independently of others, so that it will solve the present difficulties efficiently and economically, and at the same time be in harmony with the whole work and facilitate eventual extension and completion.

PART III.

ESSENTIAL FACTORS FOR SOLVING THE PROBLEM.

The requirements of a drainage system as above noted, necessitate a thorough examination into all subjects, which materially effect the nature of the design. Without a fair knowledge of the essential factors which govern the same, it is impracticable to foresee just what effects would be obtained by a certain design, and therefore, to know whether or not it will answer the purpose.

Value of topography.

First of all, it was necessary to have a topographical survey of the territory, indicating the existing and projected streets in their true position, and the character of the surface as to permeability, requiring a record of the extent of area paved and covered with buildings, or of partially built-up, and of rural and swamp areas; and further, a hypsometric survey of the entire area, indicating the height of every part of the surface by horizontal contour lines drawn at every foot of elevation above Cairo datum.

No data of value available.

The information available when the committee entered upon its duties, was to a large extent meagre, crude, and unreliable. It was deemed unsafe to base upon it the design of so important a project as the one under consideration. Therefore as a necessary preliminary step, a complete survey was recommended. The results are now available in the shape of numerous maps, indicating the surface characteristics, and of numerous profiles, indicating the sections of streets, canals, etc. Independently of the use to which these surveys are put in considering the drainage problem, they will be of use also for the solution of other municipal problems, and are therefore of permanent value to the city. For a detailed description of the topographical and hypsometric work, and for a list of the plans, etc., see Appendix III.

Value of survey for other municipal purposes.

Elevation of territory to be drained.

It need here only be stated in general terms that the territory to be drained is highest along the banks of the Mississippi River, where the elevation of the ground is on the average about 33 C. D., the ground sloping from the river towards the lake for a distance of about 6,000 to 9,000 feet from the river bank, where the average elevation of the ground is 20 C. D. The surface of ground from the foot of the slope to Lake Pontchartrain is practically flat, with the exception of a slight rise called Metairie and Gentilly Ridges, running substantially parallel with the shore of the lake and about 2¼ miles distant therefrom. The average elevation between these ridges and the lake is 22 C. D. A large portion of the basin between the foot of the slope and Metairie and Gentilly Ridges is below mean gulf level. The elevations of the territory which it is proposed to drain are more fully shown on Plate II. Under existing conditions the major portion of the territory between the ridges and the lake, as also a large portion of the basin between the river and the ridges, is swampy and practically waste land, affording very unsanitary conditions, and providing in its present condition no inducement for general improvement.

The improved portion of the City of New Orleans is situated on the most elevated part of the territory.

Navigation canals.

The New Orleans Navigation Canal, and the Carondelet Navigation Canal and Bayou St. John, extend from the lake to Rampart street, or about 4,000 feet from the Mississippi River. These canals are used for navigation purposes, admitting of commerce reaching the city from Lake Pontchartrain, and are leveed on either side to prevent the water from Lake Pontchartrain inundating the low portions of the city.

Present Draining Machines.

The present system of drainage does not extend to the lake side of the Metairie and Gentilly Ridges, and there are large areas between the river and these ridges which are not now drained. The present works consist of deep gutters on both sides of every street leading from the river to the foot of the slope, where they are intercepted by open canals leading to the draining machines. These are four in number, and arranged to deliver from an average elevation of 15 C. D., and discharge into Lake Pontchartrain. The system is, from every point of view, wholly inadequate, and the present conditions are further objectionable for the reason that all the foul and other waste waters from the improved portion of the city naturally flow down the slope from the river bank, through the numerous street gutters to the low ground in the rear, and thence to the draining machines, through artificial canals which have not the slope necessary to convey these waters with sufficient velocity, to prevent fouling of the canals, and the formation of obnoxious gases. As the foul waters accumulate in the canals, the several draining machines discharge the same into Lake Pontchartrain, where objectionable conditions are created by the pollution of the water of the lake. For a more detailed description of the present drainage system see Appendix II, and for the areas drained, as also the location of the machines, see Plate III.

Existing system inadequate.

Value of hydrography.

Another essential factor required, is a knowledge of the quantity of rain water that falls upon the territory to be drained during the heavy storms occurring several times every year. Heretofore, the available records stated only the total amount of water that had fallen within twenty-four hours, or occasionally in shorter times, and only at one point within the city limits.

Value of numerous rain gauges.

In order to have an intelligent opinion regarding the true nature and character of the storms, it was necessary for the present purpose to have a continuous record thereof, by which the rate of precipitation at every instant, and the duration of heaviest downpours is recorded. It was further necessary to know approximately the extent of the area over which a storm of great intensity usually prevails. Six self-registering rain-gauges were therefore placed at different points, as indicated on Plate III. On April 1st, 1894, these gauges were in working order and have since then furnished very satisfactory results. A few of the records of the principal storms, and the deductions therefrom, as well as a description of the method of recording the rain-fall are given in Appendix IV. In the same appendix is also found a table giving a list of rain-falls which exceeded a rate of two inches per hour in the States of Louisiana and Mississippi since the year 1872. Further, a table is inserted giving the heaviest daily rain-falls recorded in New Orleans by the United States Department of Agriculture, Weather Bureau.

The record of the storm of August 13th, 1894, illustrates the advantage of having a number of gauging stations. The precipitation was more intense during this storm than in any other which occurred during the time these investigations were being made. The total precipitation at the Park station was 2.08 inches, at the Dublin station 2.88 inches, at the Hall station 2.96 inches, at the Jackson station 3.55 inches, at the London station 3.60 inches, and at the West station 2.76 inches. The storm struck the city from the east and traveled westerly. The Jackson and London stations are the most easterly and the Park and Dublin stations the most westerly, showing that the storm decreased in intensity as it traveled.

Illustration of rain gauge records.

The records of July 4th, 1894, further illustrate the varying intensity of a storm. On this date there fell at the Park station 2.84 inches, at the Hall station 1.02 inches, at the Jackson station 1.19 inches, at the Dublin station 1.08 inches, at the West station 0.20 inches, and at the London station 0.46 inches. All the records of these instruments have been carefully plotted and the volume of water falling upon the different areas calculated and tabulated in Appendix IV.

Varying intensity of storms.

Although the rain-fall observations have so far given excellent results, and perhaps sufficient to form safe general deductions therefrom, it is yet urgently recommended that they be continued for several years. The results cannot fail to more than warrant their cost when designing the details of the drainage plan in the future.

Rain gauging to be continued.

A third essential factor required to form a judgment upon the efficiency of any design, is the amount of water and the greatest rate at which it flows off the surface and enters the drains and canals during heavy rain-falls; in other words, the actual greatest "run-off." No system of canals and drains for this city can be proportioned to do satisfactory work, to prevent overflow, or to thoroughly drain the subsoil, without a much greater knowledge of the subject than has heretofore been applied to the purpose. This information was formerly sought to be obtained by an estimate of the water lifted by the draining machines; but the record does not furnish the element of time; it does not state whether or not the "run-off" was uniform or whether it was great at one time and small at another, the capacity of the draining machines being insufficient to remove the water as fast as it comes and prevent the flooding of extensive areas.

Value of "Run-Off" investigations.

Former method of obtaining "Run-Off" data.

Another way of estimating the "run-off" was to use old formulæ, mainly in the shape of a given fraction of the hourly or daily rain-fall. The assumptions were furthermore taken from European practice, where the rain-fall differs materially in intensity and magnitude from that of the lower Mississippi Valley.

The want of reliable information on this subject compelled your Committee to obtain it as accurately as was practicable in the short time at its disposal. Actual gaugings were made of the water discharged daily at the several draining machines. With a satisfactory record of a given rain-fall, as mentioned above, it then became practicable to throw some light on the proportion of water that runs off, the remainder being evaporated or held back on the surface or in the ground. It also became practicable to estimate from these gaugings the

Results obtained by "Run-Off" investigation

ordinary flow during dry weather: a necessary knowledge to proportion the cross sections of the drains and canals, as well as the pumps to do the most efficient work at ordinary times.

"Run-Off" from large areas.

There is no opportunity in this city to gauge the immediate "run-off" from large areas, because the rain water is now held back, to a large extent, in gutters and street depressions. This fact prevents it from flowing off as rapidly as will be the case after the city has been supplied with modern pavements and other improvements which are indispensable to a modern large city.

"Run-Off" observations at Melpomene Canal.

There was at least one opportunity, however, to get approximately correct information on this subject for certain conditions, and it was an important guide for your committee in their final conclusions. This was in the area drained by the Melpomene Canal. Careful gaugings of the flow in this canal have been obtained during almost every heavy rain-fall which occurred within the past year. These gaugings, together with a knowledge of the extent and intensity of the rain-fall, and of the character of the surface, its impermeability and slope, have given a valuable factor in estimating the run-off, notwithstanding that much of the water is still held back in gutters and upon the streets before it enters the canal. Aided by information obtained elsewhere it was practicable for your committee to estimate with a reasonable degree of accuracy, the effect of this retention upon the recorded "run-off."

"Run-off" and data from other cities.

But even this information was not yet sufficient to proportion the many drains and canals under different conditions with due regard to economy. In the absence of means and conditions to obtain experimentally the suitable information in this locality, data had to be collected from other cities and interpreted on the basis of the physical character of the surface in New Orleans.

Relation of "Run-Off" to rain-fall and grade.

It is evident that the amount of "run-off" holds a fixed relation to various factors. It will be greater as the rain-fall intensity increases. It will be greater as the imperviousness of the surface increases, or as the territory becomes paved, and covered with buildings; in other words, we might say that it increases in a certain ratio with the density of population. The "run-off" increases, finally, with the slope of the territory. The steeper the slope, the quicker the water will reach a given point. The water from a distant area on a steep slope is therefore likely to meet the "run-off" from a nearer one on a flatter slope and causes the respective quantities to combine.

"Run-Off" curves.

To get information covering the effect of these factors, all the available experience in different parts of the country was consulted and compiled. The actual gaugings made in the Melpomene Canal were given their true value, and from the total results, interpreted to the best of our ability at the present time, several diagrams were prepared. Plate VIII shows the greatest probable rate of "run-off" in cubic feet per second from areas extending up to 1200 acres and with slopes of the territory ranging up to three feet per thousand, about the steepest existing slope in New Orleans. A set of these curves is given for four different characters of surface; the set marked A represents the "run-off" from densely built up parts; the set marked B applies to

the areas having small yards, or a medium density of population; the set marked C applies to the sparsely built up parts, or those having large yards; and the set marked D applies to the rural areas. These curves, therefore, indicate the maximum rate of rain-fall which it is proposed to provide for, and which is assumed to reach the drains and canals from the respective areas.

They do not warrant the assumption, however, that the discharge will never exceed the quantities given for it; in fact, it is certain that they will be exceeded, but at such rare and indefinite intervals that their consideration is not justified. It should also be remarked that the curves are based upon the assumption, that the present practice of storing the water upon the street surface will be discontinued, and that the water enters the drains promptly, as is the case in most other cities.

In proportioning the size of the canals, it is necessary to provide for future conditions, and an estimate was therefore made as to the probable future growth of the city. Little or no change is expected in the densely populated areas, nor upon others which can only be sparsely settled for some years. On the average it was not found to be judicious to assume an increase in the quantity of water running off, of more than fifteen to twenty per cent. in excess of that which would run off at present were the street storage abolished.

Future extension of city to be provided for

It is required, further, to know the quantity of ground water which will drain from the territory at ordinary times. It consists of the natural seepage from the ground, or in other words, of the water percolating into the drains and canals, and also of those waste waters from buildings, not removed by sewers. Until these sewers are extended over all of the inhabited territory, sewage will still mingle with the ordinary drainage flow, but it will decrease in proportion to their extension.

Daily flow.

The seepage itself, when coming from the built-up territory, will, however, always remain slightly polluted. It will not be as offensive as it is now, but it is nevertheless wise to provide against its becoming objectionable. For this purpose it should be removed in properly lined canals, and not in earth ditches, where any suspended matter may be deposited and where stagnation may take place. By flowing over a smooth, hard surface, and also at a velocity of several feet per second, these objectionable results will be prevented. None are found to exist where similar canals with masonry channels carry away the ordinary drainage flow from a city. This subject will be further alluded to in describing the proposed sections of the canals.

Provisions against fouling of Conduits.

In order to ascertain the quantity of water to be provided for at ordinary times, we should recognize first, that it will be reduced to below the present quantity by two causes. One, is the removal of the sewage from the drains and its disposal into the Mississippi River, the other, is the gradual decrease of rain-fall penetration into the ground by a greater building up and paving of the city. On the other hand, the quantity will in the future tend to be increased, by the fact that the drains and canals will be deeper than at present, thus furnishing better conditions for infiltration from the river and from the lake. In

Quantity of daily flow.

view of these opposing tendencies it has been concluded that a provision for the ordinary flow in the future should be based upon the present quantities, as deduced from the records obtained at the several draining machines, and as given in Appendix V. They have been adjusted to the proposed new drainage sections of the city, and represent the amounts probably to be lifted at the proposed pumping stations. The resulting effect of the proposed manner of removing the ordinary flow of water, will be to materially lower the water level over all parts of the territory under consideration, including the swamp areas, and to keep the entire territory permanently dry and available for improvement.

Reducing moisture line

In the opinion of your committee, the principal reason why so many projects for the solution of the drainage problem have been proposed, and again abandoned, is the fact, that insufficient information was at hand to definitely, and positively, determine its hydraulic features, and that there could be no assurance regarding the exact effects, or the results, that would ensue upon the carrying out of any of the numerous propositions.

Reasons of failure of previous drainage projects.

PART IV.

PROJECT RECOMMENDED.

A.—OUTFALLS.

The first and most important part of the problem to be determined is the final disposition of the drainage water, or in other words, the outfalls. Having fixed these points, the lines of the canals collecting and delivering the water, can then be suitably arranged.

There are, in the main, three localities where it can be disposed of, namely: the Mississippi River, Lake Pontchartrain and Lake Borgne. It will not require more than the mere statement, that the river should not be the receptacle of the drainage water. The ground slopes naturally from the river levees back to the swamps and the lakes. The surface water therefore flows away from the river. To reverse its flow would require deep and large canals through the city to the river. As the latter is usually higher than the surface of the largest part of territory to be drained, all the water would have to be pumped, and during freshets the lift would be considerable.

Points of disposal for drainage.

Economical drainage outfalls are to be sought either in Lake Pontchartrain or in Lake Borgne; at present the former is used for this purpose.

It was above stated that the ordinary drainage flow and the water from slight rain storms, although considerably improved after most of the sewage has been separated therefrom, will still be somewhat polluted, and its outfall should therefore be selected so that no objectionable consequences can arise. It was also stated, that the water from heavy rainfalls will so dilute any objectionable matter that its disposal can be accomplished without reference to any but economical requirements.

The advantages of and objections to Lake Pontchartrain receiving the drainage are as follows:

It is nearer to the center of the city than Lake Borgne and the canals discharging the water will therefore be shorter and less expensive. It is at present used for an outfall, and several canals already lead to it from the city, making a continuance of this method of disposal less expensive than a different method. On the other hand, numerous pleasure resorts are located along the shore. It is therefore desirable to protect the lake water even from slight pollution. The lake is land-locked, which prevents a rapid tidal flow in and out, or any material circulation of its water. Under these circumstances, as is the case at present, a pollution becomes a serious matter. A discharge into the lake of the ordinary flow and of that from light storms should therefore be avoided. The water from heavy storms on the other hand can be discharged into it without detriment.

Final disposal into Lake Pontchartrain

The advantages of and objections to Lake Borgne as a receptacle for the drainage are as follows:

Final disposal into Lake Borgne.

The borders are mostly uninhabited and a slight pollution of the water has no disadvantages. It is open to the Gulf, and the tides rise and fall more rapidly. The greater fluctuations cause a more complete dispersion and a more rapid removal of the drainage water. The mean level is several inches lower than Lake Pontchartrain. The distance from the city to the lake is somewhat greater, but Bayou Bienvenu, which by dredging can readily be made of sufficient size to convey the drainage water, runs from the lake nearly to the levees of the city and can be utilized, without detriment, to receive the drainage flow. It is, also, the natural outfall for the drainage of a large part of the city.

Conclusion as to point of final disposal.

In our opinion, the proper place therefore to discharge the daily drainage from the City of New Orleans, and the more or less polluted water from light storms, is Lake Borgne. Although farther from the city, it possesses, as indicated, a number of material advantages over Lake Pontchartrain as a drainage receptacle, which make it decidedly preferable.

Lake Pontchartrain as Relief outfall.

The amount of rain water which must be discharged after heavy storms is, however, so great, that it becomes impracticable to carry all of it to Lake Borgne. But as the water is then less objectionable in quality, it can be delivered with impunity at the shores of Lake Pontchartrain. Therefore, only the water from light rains and the daily flow should be taken in a canal to Lake Borgne, and relief canals at suitable points along the route should take the excessive quantities to nearer outfalls situated along the shores of Lake Pontchartrain. A discharge into the latter will then take place only occasionally, and after the first wash of heavy storms has been directed towards Lake Borgne. The character of the drainage water delivered into Bayou Bienvenu and the Lake, will by no means be sewage, nor resemble the water now observed in the drainage canals of the city, as the proposed sewerage system has a capacity sufficient to prevent the foul water of the built-up parts of the city from reaching the drains, and for delivering all of it into the Mississippi River.

B.—GENERAL FEATURES.

The various plans and suggestions for carrying the drainage to the outfall, which have been before the committee, were carefully compared as to efficiency and cost of construction, pumping, and general maintenance, with the result that the following general features of a plan are recommended as accomplishing the most efficient and comparatively least expensive drainage of the city, both ultimately and for the present.

In the statement of the general requirements for a drainage system, the territorial limits were designated for which it should provide improved drainage, that is adapted to present as well as future conditions, when the population has materially increased, buildings are more densely crowded and the paving of streets is more extended and impervious. The territory embraced within these limits has been divided into drainage sections as follows: Division into drainage sections.

The First Section includes the area between the river and the lake, and between the upper limit of the city and a line extending along the New Canal and thence by Howard avenue, Camp street, Poeyfarre street, Magazine street and midway between Gaiennie and Calliope, between Fulton and S. Peters, and between Thalia and Melpomene streets, to the river. This section contains 8,887 acres. First.

The Second Section includes the territory between the First Section and the Bayou St. John, Carondelet Navigation Canal and Toulouse street. Its area is 5,384 acres, of which 1,293 are between Broad street and the river, and 4.091 between Broad street and the lake. Second.

The Third Section lies between the lower limit of the Second Section and the line of People's avenue, Gentilly Ridge, London avenue, Broad street, St. Bernard avenue, Claiborne avenue and Elysian Fields. It includes 1,118 acres between Broad and Hope streets, Florida avenue and the river, and 3,564 acres between Broad and Hope streets, Florida avenue and the lake. Third.

The Fourth Section comprises the territory between the lower limit of the Third Section and Gentilly Ridge, People's avenue, Florida avenue and Independence street. Its entire area, 2,153 acres, is between Gentilly Ridge and the river. Fourth.

The Fifth Section embraces the territory between the lower line of the Fourth Section and the lower line of the city, and contains 2,878 acres. Fifth.

The territory on the right bank, designated as Algiers Section, comprises the territory between the upper parish line, lower limit of U. S. Reservation, Mississippi river and rear protection levee, containing 948 acres, and is treated as a separate section. Algiers.

The boundaries and areas of these sections are shown on Plate IV.

Main Canal: its essential features:

The reasons hereinbefore presented have led to the conclusion that it is desirable to deliver the greatest practicable volume of drainage water from the entire city through a canal connecting with the headwaters of Bayou Bienvenu and thence into Lake Borgne. Therefore, a main canal leading through the area to be drained, and to which the branch canals and drains of the several sections described are tributary, is made a fundamental feature of the plan.

Its location.

The location of this "main canal" is shown on Plate IV. It extends from the intersection of Nashville avenue and Claiborne street in a direct line to the present head of Broad street at Napoleon avenue, and along Broad to Hope street at the intersection of Bruxelles street, and thence along Hope street and into and down Florida avenue. The connecting canal from Florida avenue to Bayou Bienvenu will be dredged, and certain reaches near the head of the Bayou enlarged by dredging, and cleared by the removal of sunken logs.

The contours and profile on Plate II show that the main canal is located in the lowest depression between the river and the Metairie and Gentilly Ridges, and therefore, in the drainage of the city, it makes the greatest use of gravity that the topography allows.

Functions of main canal.

The duty which this canal is to perform is the removal, not only of the daily flow during periods when there is little or no rainfall, but all run-offs from storms in the several sections, which do not exceed, in any part of its length, its ultimate discharging capacity. It also serves as a basin for the collection of storm-water (to the extent of its cubic contents), during the time necessary to get the pumps started.

It is provisionally designed with a main (or high-water) channel, and a sub (or low-water) channel. The width of the high-water channel is about 70 feet, and the maximum depth at or about 5 Cairo datum, or 15 feet below the mean natural surface (20 C. D.) on the line of its location. These dimensions have been limited by considerations of convenience and safety in construction and with a view to a discharge of 3,000 cubic feet per second.

It is proposed to line the entire bed and sides with smooth and permanent material in order to insure cleanliness, and a good velocity and discharge. When crossing the navigation canals, special study will be required as to the best detailed method of so doing. But in no case will there be any practical difficulties. The water will probably be best carried across and under the same by large iron pipes, in such a manner as to avoid a depression or siphonic action, and any trouble in maintenance.

As this main canal, in its entire length and dimensions, will only be required when, to the run-off from the city in its present condition, is added that which is estimated for the improvements and extensions of the next 50 years, and as it is not included among the earlier parts of the construction which are recommended further on in this report, for the purposes of affording immediate relief, it is wise to leave the final determination of its exact dimensions to the experience which will be acquired as the work progresses.

Branch canals start from the main canal, and then diverge with constantly decreasing capacity, separating into main drains, branch drains, and surface gutters, which extend to the limits of each section, however remote, on either side of the main canal. The system is shown on Plate IV, and has, in addition to that furnished by the main canal, a large storage capacity.

Branch Canals.

Other Conduits.

The details of the plan include the re-grading and lining of the street gutters. These will be of shorter length, of smaller size and discharge than at present, and constructed in such manner as ultimate location and other conditions will determine. When their necessary capacity would become too large, branch drains are substituted, which have smooth and permanent sides and bottoms, and are generally to be covered. Their dimensions should be such as to admit of location under the sidewalks. Their direction and location is controlled by the contours of the ground, so as to give the greatest efficiency in collecting the drainage.

Street gutters.

Branch Drains.

The volume of water accumulating in these branch drains is intercepted by main drains, whose general direction is at right angles to the former. This volume requires dimensions, which, in some cases, admit of a location under the sidewalk, but in others require it to be under the road-way. In both cases, they are covered and provided with man-holes for inspection, cleaning and repair. These main drains in turn discharge into branch canals, which lead directly into the main canal. Their construction is similar to that of the main and branch drains, but they have greater dimensions. These details of location, excepting for the surface gutters are plainly shown on Plate IV. A list of the branch canals in each section and a tabulation of their discharges is given below, while the same information concerning all the other lines of drainage is given in more detail in Table XI.

Branch Canals.

The drainage of the First Section is collected into eight Branch Canals, which are tributary to that part of the Main Canal located immediately above the New Orleans Navigation Canal and Pumping Station No. 1. Of these Branch Canals, six on the river-side are located respectively on Claiborne, Nashville and Napoleon avenues and on Toledano, Melpomene and Venus streets; and two, on the lake-side, on Claiborne avenue and Venus street. The last mentioned is in its functions at different times either Branch or Relief canal, as explained below.

First Section.

The drainage of the Second Section is collected into two Branch Canals, tributary to the main canal between the two Navigation Canals, which is served by Pumping Station No. 2, located immediately above the Carondelet Navigation Canal. Of these two branches, one is on St. Louis street on the river-side of Broad street, while the other, occupying the location of the present Toulouse Canal, drains the area on the lake-side of Broad street, and has the same alternate functions as the Venus street Canal above mentioned.

Second Section.

St. Louis street branch canal.

The Branch Canal on St. Louis street for the drainage of this section between Broad street and the river, is well located and entirely practicable. Should the city have the opportunity to acquire, for drainage purposes, the use of that part of the Carondelet Navigation Canal, situated between its head at Basin street and the lake side of Broad street, at a reasonable cost and without prejudice to the navigation and commercial interests of the community, it could be used to advantage for these purposes, and in lieu of the St. Louis Canal. The construction would be cheaper on the line of the Navigation Canal than on St. Louis street, as a covering to restore the present St. Louis street pavement would not be required. A crossing of the Navigation Canal by tunnel or siphon would also be obviated, although this feature does not present any special difficulty or great cost. On the other hand the re-establishment of commercial and navigation facilities by the construction of a basin and wharves at or above Hagan avenue and the building of streets leading thereto will be a necessary part of this alternative, and it is quite probable that the cost of these, together with that of acquiring the partial use of the Navigation Canal, and the opposition with which this, as a new proposition, might be met, would nullify any advantages the suggestion possesses.

Partial use of Carondelet Canal.

Advantages.

Objections.

Third Section.

The drainage of the Third Section is brought through four Branch Canals to the Main Canal. Those on the river-side are, respectively located on Orleans street and St. Bernard avenue. Those on the lake-side enter the Main Canal from Orleans street and London avenue, and the latter also serves both as a Branch and Relief canal, as do those in the First and Second Sections already mentioned.

Fourth Section.

In the Fourth Section there are five Branch Canals tributary to the Main Canal. Three, from the river-side, enter at St. Anthony, Washington and Lafayette streets, while two, from the lake-side enter at Marigny avenue and Washington street.

Fifth Section.

In the Fifth Section their are four Branch Canals. They are located on Louisa and France streets and Jourdan avenue, while one comes from the lower limits of the section.

Algiers.

In Algiers, there will be a pumping station on Lawrence street discharging the drainage of this section into an outfall canal, leading into Bayou Barataria.

The principal Canals leading thereto are on Lapeyrouse street, Vallette street and Canal avenue.

The proposed plan thus provides for the thorough drainage of every part of the city, within the boundaries described, which other plans do not.

It is less expensive than any of the others before us, if they were all made equally efficient and built in the same substantial manner as proposed further on. It is also less expensive in maintenance than any of the others including pumping and keeping the channels clean, if they are to accomplish the same results in drying the wet grounds and in removing the storm-water; and if the channels are equally well built.

Also, it is superior in its sanitary effects on account of the removal of the ordinary polluted drainage to Lake Borgne and the improvement of the condition of the shores of Lake Pontchartrain; also on account of the better velocities throughout the system by which any foulness or undesirable deposits are much reduced.

C.—RUN-OFF PROVIDED FOR.

The run-off to be collected into the minor canals and discharged through them into the main canal, is computed from the run-off curves represented on Plate VIII described above in which due consideration is taken of heavy rain-falls recurring with sufficient frequency, to make their entire and immediate removal necessary, of the surface slope, of the character of the drainage areas, and of the present and prospective density of population.

Run-off computed from curves.

These curves are based upon the results of the surveys, gaugings and observations made by the City Engineer's Department under the advice of the Advisory Board during the past two years and upon a comparison of these results with those of similar observations in other cities presenting like conditions.

Surveys, Gaugings and Observations.

PROBABLE RUN-OFF IN CUBIC FEET PER SECOND.

Section.	Branch Canals, Riverside.	Branch Canals, Lakeside.	Discharge Cu. Ft. per Second.	Discharge Cu. Ft. per Second.	Aggregate for Section.
FIRST.....	Euphrosine.....		184		
	Melpomene.....		1,630		
	Napoleon.....		1,255		
	Nashville.....		770		
	Claiborne.....		72		
	Toledano		31		
		Claiborne.....		164	
		Venus.....		1,298	
			3,942	1,462	5,404
SECOND.....	St. Louis.....		1,458		
		Toulouse.....		1,131	
			1,458	1,131	2,589
THIRD	Orleans.....		383		
	St. Bernard.....		767		
		Orleans.....		62	
		London Ave....		515	
			1.150	577	1,727
FOURTH.....	St. Anthony ...		98		
	Washington....		100		
	Lafayette..		827		
		Washington....		141	
		Marigny		90	
			1,025	231	1,256
FIFTH.....	Jourdan		733		
	Louisa		58		
	France.....		58		
	Florida Ave.....		409		
			1,258		1,258
Algiers.—Aggregate discharge for this Section ..... 671.					

Results.

The amounts in the fourth and fifth columns of the foregoing table, represent the run-off which may occur from any of the areas of the territory according to their differences in extent, slope and density of population. The discharge given for each branch canal may, at times, reach the main canal; but in any one section, the greatest run-offs from its several sub-divisions will not reach the main canal at the same time. The tributaries are of different lengths. They come from

Diversity of conditions.

tracts with different surface slopes, extent, shape and character. One section is a narrow strip, from the river to the lake. At one end is the most densely built and completely paved part of the city, with a steep, short and direct run-off to the main canal, while at the other is the low flat area, thence to the lake, with long leads and light grades.

Another section is roughly semi-circular, with the Branch Canals converging from several directions with approximate regularity, from comparatively uniform slopes, and areas more homogeneous in the character of their settlement than is the case in other sections.

Every section, particularly the second section, comprises extremely varied conditions of urban and suburban drainage.

These different conditions determine the relativeness of discharges from the branches into the Main Canal, and the effect thereof must be considered in estimating the volume to be dealt with at any one time, or at any one pumping station.

While every tributary to the Main Canal, or to any canal immediately above a pumping station may at sometime during a storm run completely full, it is very improbable that all of them will ever run full at the same time.

In each of the sections again, the run-offs from the several Branch Canals reach the Main Canal at different points, as well as at different

Influence on time of Discharge.

times. The differences in the time of arrival of largest run-offs from the several Branch Canals at the pumping stations may, therefore, be greater in some instances than the differences of the time of their delivery into the Main Canal.

Finally, for the reasons just applied to the run-offs within the different sections of the city, and for the additional reason that a violent rain-fall seldom pervades the entire drainage area of the city at the same time, and with equal intensity and duration, it is still more improbable that the run-offs of the different sections will all combine so as to pass through any one of the sections of the Main Canal at the same time.

Therefore, it is certain that a reduction can be made from the sum of the volumes given in the preceding table. The conditions are so various, and admit of so many combinations, that this reduction is largely and properly a subject for the judgment and experience of the constructing engineer.

The plan now being described, contemplates the completion of every part and detail, Main and Branch Canals, Drains and Branch Drains, Pumps and Out-fall Canals, with a view of meeting the requirements of the city with the development and extensions that may

occur within not less than fifty years. Even were it financially practicable, it is evidently unnecessary and unwise to do a large part of the desired work for a long time to come.

As the canals and drains are intended to deliver the surface run-off to the pumping stations, the completed pumping power will not be required until the entire completion of the drains and gutters. Under these conditions, during the time of construction and use of those parts of the plan which it may be decided to put in at present, and from time to time, there will be ample opportunity for the observation and experience required for a revision of the ultimate figures, as herein given, if this should be necessary. This course insures efficiency and economy. Features contemplated

The amounts given in the fourth, fifth and sixth columns of the foregoing Table are, therefore, excessive, for the purpose of estimating the required pumping power. The reductions proposed are stated in detail in a description given below of the different pumping stations.

But with any reduction, which, for these reasons, can be made from the volumes in the table, the remaining amounts are in excess of the discharge which can be obtained by the natural slope of a canal built under the existing topographical conditions.

D.—VELOCITIES AND CROSS SECTIONS.

The dimensions of a canal or drain are calculated not only from the quantity of water to be removed, but also from the velocity with which the water can flow, for, the smaller this is, the larger must be the cross-section. Velocities are determined by the slope and character of the perimeter of the channel. They are limited in this case by the available slopes and the nature of the channels.

When these are lined with masonry, the velocity can be as great as obtainable by any slope available in New Orleans, perhaps 8 feet per second. When the channels are not lined, they are subject to erosion and the velocity should not be greater than that which prevents a destruction of the bed. In earth channels, though protected somewhat by the growth of vegetation, and considering that the greatest flow and therefore velocity is not continuous, but occurs only after rainstorms, the computations have been based on a maximum velocity of 3½ feet per second. When the slope would cause a greater velocity the channel is assumed to be lined. But in unpopulated districts, where this would be unnecessarily expensive at first, it is desirable to reduce the slope temporarily by increasing the sectional area.

Conditions governing Velocity.

The least velocities of flow in the drains and canals should be greater than those usually assumed for sewers, because heavy materials, such as sand, etc., are carried along in them. The least velocity in masonry lined conduits for the removal of storm-water has been assumed at three feet per second, and for the removal of the ordinary flow, to prevent deposits and gradual filling up, at six feet per second.

Pumping this ordinary flow and that of small storms in the Main Canal, will, of course, increase the velocity by increasing the slope, and therefore the discharge.

With the above assumption the slopes of the canals and drains have been obtained, and in view of the large quantities of storm-water to be dealt with, the slopes were made as great as practicable.

Slopes.

In the larger canals it is advisable to have special sub-channels of sufficient capacity to convey the ordinary flow. This channel can then be made to deliver its charge with the best velocity and concentration of the volume, instead of spreading out over the wide section necessary for storm-water removal, thus facilitating deposit and causing an unsightly appearance.

Sub Channel.

For storm-water removal, the sections adapted for the numerous canals and drains are governed by the feasibility of making the excavation, by the necessary highest elevation of the water, and by the required capacity to discharge given amounts of water. As a rule they should be shallow and wide.

The plan proposed, and for which estimates are furnished, includes the lining of the sides and bottoms of most of the canals and drains and the covering of the smaller ones, between Broad Street and the

Construction of Canal.

river and in the built-up part of the city, in a durable manner and with a smooth interior surface. Eventually, nearly all of the drains and canals will require a similarly pernament lining, but for a long time this necessity will not exist. But whenever they are permanently improved, their section should be made large enough for all time.

Wherever practicable and necessary, the drains and branch canals should be covered, so as to gain the use of the surface of the street, guard against the danger of persons and animals falling into them, and to protect them from an excessive amount of street rubbish being thrown into them.

Covered drains not unsanitary.

It has been stated that covered drains and canals would become offensive. But this is not to be expected after the sewerage system has been completed and the greatest portion of foul matter removed from the drainage. In Paris the street water and house sewage, excepting most of the excrementitious matter, are carried off in covered channels with wide and untrapped openings at the gutters to receive the drainage, and without being offensive.

The special manner of covering, as well as the many difficult problems of detail that must be considered in the execution of the proposed drainage plan, in order to achieve success and at the same time be economical, should be left to the constructing engineers.

E.—PUMPING STATIONS.

Description of Main Canal.

The surface of the ground along the line of the Main Canal is practically level, ranging from 19.5 to 21.5 C. D. The length of the canal is seven miles, the width is provisionally assumed at about 70 feet, and the depth is limited by the stability of the subsoil, and varies from 14.5 to 16.5 feet below the natural surface. Where it discharges into Lake Borgne, the mean tidal level is 21.26 C. D., but this may be increased three feet or more in great storms.

Functions of Main Canal.

The Main Canal is to serve two distinct purposes. In the first place, it is intended to remove the ordinary drainage flow to the proposed outfall, in a proper manner. Owing to the great distance, the absence of fall, the fact that such ordinary flow should be given a suitable velocity, and in order to prevent sanitary objections in the future, it is absolutely necessary to lift this ordinary flow at a sufficient number of points so as to give it artificially the slope which cannot be had naturally by the topography. The plan, therefore, includes a series of main pumping stations, five in number along the Main Canal.

Simultaneous operation of Pumps not always necessary.

Secondly, the Main Canal is to carry away the water from rain-falls to such an extent, that the first wash from the surface of the streets, will as far as practicable be discharged into Bayou Bienvenu and Lake Borgne, rather than in Lake Pontchartrain. It has been considered that a rain-fall giving a run-off of 3,000 cubic feet per second, at the lower end of the main canal, might be sufficient for the above purpose, and the canal has been provisionally designed for this quantity. For small rain-falls it will seldom be necessary to operate all the pumps, as any flow greater than the ordinary, will require a lighter slope for a given velocity, and the water can flow by gravity past several of the pumping stations without objection. In fact, there will be times after moderate rain-falls, when the water slope in the Main Canal can be made sufficient by the operation of merely the terminal pump at Jourdan Avenue, to finally deliver the run-off beyond the drainage limits. Therefore, provision must be made at each of the pumping stations on the Main Canal, for allowing, at certain times, an unimpeded flow, and at other times, for holding the artificial head which the pumps will make.

Disposal of Excessive Rain-fall.

When the capacity of the lower end of the main canal becomes insufficient to carry off the water from a storm, then it is necessary that the pumps deliver the excess into the branch relief canals, to flow to the auxiliary pumping stations, hereinafter described, and thence into Lake Pontchartrain. This surplus water will as a rule, be wholly unobjectionable in its character, and if it is discharged into Lake Pontchartrain will give no offense whatever.

Provision must therefore be made at the pumping stations for these several duties.

The pumps must handle, at certain intervals of distance, the daily flow during periods when there is little or no contribution from rain-fall, so as to give fall and velocity for its discharge into Lake Borgne.

The volume of this dry-weather flow from the several sections, is estimated to be as follows: **Volumes of Normal flow.**

First Section, 12.3 cubic feet per second.
Second Section, 12.5 " " " "
Third Section, 6.2 " " " "
Fourth Section, 3.0 " " " "
Fifth Section, 4.0 " " " "

Total, 38 cubic feet per second. For details of this daily flow, see Appendix V.

These amounts are progressively cumulative, and for their removal the daily operation of the pumps, on the line of the Main Canal, will be necessary. The lift at each pumping station will be from three to four feet, except at Pumping Station No. 5, where it is delivered into the main out-fall canal. As before described, a sub-channel of the Main Canal, as shown in Plate IX is designed to carry this flow within its banks. **Lifts at Main Pumping Stations.**

During ordinary storms, the lift for high water pumping will be about the same as that for pumping the low water flow, but the volume will of course be much greater. Further details concerning these lifts and volumes, are given below.

If the diversion of the excess of volume from the Main Canal to Lake Pontchartrain were accomplished solely by the pumping stations along the line of the Main Canal, the distance to the lake with the slope necessary to properly discharge the required volume, would demand a very great lift; and the branch relief canals being in such case on a high level, would not admit of the easy drainage of the areas situated between the ridge and the lake. These difficulties might be removed by the establishment of additional pumping stations, either on or near the lake shore, which would divide the lift, bring the canal to a low level and admit of the drainage of the adjacent lands. But there are objections to this location of the pumps, as follows: **Necessity of Auxiliary Pumps.**

1st. The daily or dry-weather drainage, seeking this canal, would have to be removed from the lower end into Lake Pontchartrain, and require the daily operation of these outlying pumps, as well as of those along the Main Canal, and causing the continuous pollution of the lake which it is desired to prevent in the future. **Objections to placing Auxiliary pumps on Lake Shore.**

2d. The bottom of the relief canal, at its lower end, would be at a depth where the stability of the sub-soil is doubtful.

Auxiliary pumping stations centrally located between the ridge and lake could not be subject to such objections and would give more prompt and efficient drainage, and are therefore, recommended.

The plan provides for such locations at Bordeaux street, and Taylor and Monroe avenues, as shown in Plate IV. The lift is moderate and the intermediate reach between the two pumping stations, is lowered to a level which will serve for the rapid and complete drainage of the low tracts between the ridge and the lake. **Proper location for Auxiliary Pumps.**

In dry times, the drainage water of these lands will seek the low level reach of the branch canals, and flow by gravity through a by-pass, provided at three of the main pumping stations, into the sub-channel of

Disposal of Normal flow from rear sections.

the Main Canal, for a final disposal into Lake Borgne. During a higher flow in the Main Canal, these low level reaches of the branch canals serve for purposes of temporary storage, until a further rise of the water renders it necessary to start the auxiliary pumps at the other end of the reach. At no time should the water surface be allowed to rise sufficiently to flood the lands along the banks of the low level canal, or arrest its drainage.

Your committee is not prepared, at the present time, to give exact information regarding the capacity which should be given to all of the pumps to be erected at the different stations; because it depends to a large extent on the improvements that are intended to be made in the drainage system within the next few years. However, a general outline of the location and work required of each one, as forming part of the recommended plan, and approximately the volume and lift are given as follows:

Capacity of Pumping Stations.

The volumes assumed are smaller than those given in the table on page 29, for the reasons hereinbefore stated. Pumping stations numbers 1, 2, 3, 4 and 5, along the line of the Main Canal, are designated "Main Stations;" and numbers 6, 7 and 8, at the ends of the Branch Relief Canals, are designated "Auxiliary Stations."

Main Station No. 1.

Main Station No. 1 is located on the line of the Main Canal at Venus street, and disposes of the drainage of the First Section. The aggregate run-off through the several branch canals of this section, as shown in table on page 29, during the greatest storms provided for, is 5,404 cubic feet per second. As the Branch Canals, tributary to this section of the Main Canal, converge from different directions, mainly from large areas of easy grades, and small density of population; and as they are of considerable length, and together with the Main Canal, afford a large storage capacity, for reasons assigned on page 30, a reduction of one-third may be made from the above amount. The run-off to be pumped at this station, at any one time, is therefore assumed at 3603 cubic feet per second. But a further deduction of 865 cubic feet per second can be made, because this quantity enters the Branch Relief Canal between Pumping Stations numbers 1 and 6 from the lands of the section in therear of Metairie Ridge, and will be pumped at the Auxiliary Station No. 6.

Auxiliary Station No. 6

The Main Station No. 1, therefore, deals with 2738 cubic feet per second, as follows: 1750 cubic feet are to be lifted from an elevation of 16 to 19 feet above C. D., and delivered into the Main Canal of the Second Section, and 988 cubic feet are to be lifted from an elevation of 16 to 20 feet above C. D., and delivered into the branch relief canal leading to the Auxiliary Station No. 6, at the intersection of Bordeaux Street and Upperline Canal. At the latter 865 cubic feet will be added, as mentioned above, giving a total volume of 1853 cubic feet per second to be lifted at this Station, in times of extreme rain-falls, from an elevation of 15 to 27 feet above C. D. This latter lift is not only the necessary head to effect a discharge at mean lake level, which is 21.26 feet above C. D., but also during exceptionally great storms, which may raise this level 3 or 4 feet.

Following the same method of estimating, the present volumes to be provided for by pumps at the other Main Stations are as follows:

Main Station No. 2.

Main Station No. 2 on the Main Canal, at the intersection of St. Louis street, according to the table on page 29, may receive a run-off of 2589 cubic feet per second from its two tributaries. The amount from the river-side, being 1458 cubic feet, is not materially reduced, but assumed at 1400 cubic feet, while that from the ridge is reduced from 1131 to 700 cubic feet, giving an aggregate of 2100 cubic feet per second. The run-off from the Second Section to be provided for at Station No. 2 in great storms is therefore 1400 cubic feet per second. To this is added the volume pumped at Main Station No. 1 from the First Section, namely 1750 cubic feet.

Main Station No. 2 therefore deals with 3150 cubic feet per second, as follows: 2250 cubic feet are delivered into the Third Section of the Main Canal, with a lift from elevation 17 to 20 feet above C. D.; 900 cubic feet are delivered into the branch relief canal with a lift from elevation 17 to 19 feet above C. D., and conveyed to the Auxiliary Station No. 7, at the intersection of Taylor Avenue and Orleans Street. Here are added the 700 cubic feet assumed as being tributary to the Branch Relief Canal, giving a total volume of 1600 cubic feet to be lifted from an elevation of 14.08 to 27 feet above C. D., and flow to the lake by gravity.

Auxiliary Station No. 7.

Main Station No. 3.

Main Station No. 3, on the main canal at Hope street, according to the table on page 29, receives an aggregate run-off of 1727 cubic feet per second, of which 1150 cubic feet are from the river-side. The latter is assumed at only 1000 cubic feet, to which is added 2250 cubic feet, delivered from the Second Section, making an aggregate to be lifted at Pumping Station No. 3, of 3250 cubic feet per second. Of this quantity 2000 cubic feet are delivered into the Fourth Section, with a lift from elevation 17.4 to 20 feet above C. D., and the balance, 1250 cubic feet, into the Branch Relief Canal, with the same lift. At the Auxiliary Station No. 8, located at the intersection of London and Monroe avenues, this amount together with 300 cubic feet representing the run-off from the rear lands, or together 1550 cubic feet per second, is lifted from elevation 16.40 to 27 feet above C. D.

Auxiliary Station No. 8.

Main Station No. 4.

Main Station No. 4, at Lafayette avenue and the Main Canal, according to the foregoing table, receives a total run-off of 1256 cubic feet per second, which could now be reasonably reduced to 1000 cubic feet. This amount is increased by 2000 cubic feet from the Section above, making 3000 cubic feet per second to be disposed of as follows: 2500 cubic feet per second are discharged into the Fifth and last section with a lift from elevation 16.5 to 20 feet above C. D., and 500 cubic feet per second into the Peoples' Avenue Canal with a lift from elevation 16.5 to 27 feet above C. D., sufficient for the water to flow into the lake by gravity.

Main Station No. 5.

Main Station No. 5, at Jourdan avenue receives 2500 cubic feet per second from the Fourth Section, and about 500 cubic feet per second as the reduced run-off of the Fifth Section. These quantities are delivered with a lift from elevation 16.68 to 28 feet above C. D., into the canal leading to Bayou Bienvenu and thence into Lake Borgne.

Algiers Station.

The drainage of Algiers on the right bank of the Mississippi river, as shown on Plate IV, is accomplished by a similar system of Gutters, Branch and Main Drains, and Branch Canals leading into a Main or Intercepting Canal located on Canal avenue. From a main pumping station, located near the intersection of Lawrence street and Canal avenue, the total run-off of the section, amounting to 671 cubic feet per second, may be reduced to 400 cubic feet per second, and will be lifted from an elevation of 18 to 25 feet above C. D., and delivered into the outfall.

Necessity of care in operating system.

For the purpose of obtaining the fullest advantage of the proposed system it must be kept pumped down, throughout all its branches and mains, to the lowest possible level. Constant vigilance and care must also be exercised to keep both the larger and smaller canals free from deposits of every kind. They will not all be entirely self-cleansing, and neither this nor any other system will be worth building, unless ample provision is made for its care and operation.

In the foregoing is approximately stated: the daily flow, which requires to be lifted, at the various Pumping Stations, in order to keep the territory dry; the run-off or storm-water flow which will probably have to be lifted and discharged into Bayou Bienvenu, and, during excessive storms, also into Lake Ponchartrain; finally, the capacity of the pumps at the several stations.

This stated capacity will not be at present required, but, as the population increases, and the surface, upon which the rain falls, becomes more impervious, proportionately more water will run-off into the canals and require pumping. The rate at which this quantity will increase, must be left to future observations, which, from time to time, will determine how soon and to what extent the pumping power of each station should be increased.

Ultimate pumping capacity determined by extent of improvements

As already mentioned, there is a large storage capacity in the canals, which will be utilized until the storm pumps can be put into operation. The problem which will require attention in the future, is not only to find the capacity of the pumps required, to throw out the greatest quantity of water that will enter the main canal in each respective section, after it has filled up and the limit of its storage capacity is reached; but also to pump out the stored quantity itself in that space of time within which it is desired to have the canals resume their ordinary condition of flow. These questions can be readily determined after some portions of the drainage system have been put in operation. It is impracticable to answer them with sufficient accuracy at present, nor is it necessary. In the future, pumps should be added as they are needed, and sufficient land should now be acquired at each station, and the structures be designed to admit of extension.

The present draining machines, though simple in their action and requiring but ordinary intelligence to operate, are nevertheless by no means economical for the purpose of lifting the water. Since they were built, the progress in the design of pumps has been considerable; and advantage should be taken thereof in establishing the Pumping Stations for the proposed work.

PART V.

PROSECUTION OF WORK; ITS PROPER ORDER AND EXTENT.

Plans Adapted to Means Available.

Without prejudice to its final completion the plan allows great latitude in the order with which the construction of its several parts may be undertaken in any section. It also permits the execution of effective work to any extent however small or great for which means may be, or may become, available. Almost any one of the numerous, canals, branches, drains, pumps, etc., proposed in the plan, may be built with the certainty that its immediate effect will be to relieve, to some extent, certain parts of the city from their present unsatisfactory condition as regards drainage, and that the work done will be of permanent and increasing value, as the extension of the plan proceeds.

But the largest benefits will, in general, closely follow the locality where the works are most nearly complete. Thus, if only the Main Canal, with its Pumping Stations and Relief Branches were put in operation, the drainage of their immediate vicinity would be at once accomplished; though little or no benefit would result to the remoter regions until they were penetrated by the Branch Canals and Drains, designed to carry off their drainage, and these conduits were, in turn, connected with an improved system of street grades and gutters.

Beneficial results immediate in vicinity of work.

On the other hand it is evident that while the grades and gutters of the streets in any portion of the city may be so improved as to greatly facilitate drainage, such improvement can only effect a local benefit, the Main Drains, Canals and Pumps being necessary for the final disposal of the run-off. Both parts of the plan, the pumps and main canals, as well as the minor channels and improved street grades and gutters, are essential for the efficient drainage of any of the sections. Nevertheless, the several sections may be separately treated, in case considerations of finance or policy, or other reasons, are found to make such a course desirable. But no part of the improvement should be undertaken which in its effect, increases the quantity of water collected at any point, without providing for the necessary pumps and canals to properly dispose of it.

All the run-off may be temporarily discharged into Lake Pontchartrain.

As it is proposed to discharge the excessive volumes of storm-water, brought to the Main Canal from the upper sections of the city, into Lake Pontchartrain by means of Relief Branches and Auxiliary Pumps, it is of course entirely practicable to allow for the present, all the run-off, both from excessive storms and from daily flow, to be discharged from any of these sections into Lake Pontchartrain. The drainage thus carried to the Lake would not be more polluted than that now delivered there, and whenever the Main Canal was completed for service, any nuisance would be at once abated, and the operation of the system could, thereafter, proceed in accordance with the completed plan, and the drainage be delivered into Lake Borgne.

Main Canal essential but its completion may be postponed.

While the ultimate construction of the Main Canal to its outfall through Bayou Bienvenu, into Lake Borgne, is an essential feature of the plan, its completion as a continuous channel of discharge may, if time or means are wanting, be postponed, and only such parts of its length as are necessary to convey the run-off from the several sections to the nearest pumping stations, or to serve for storage purposes need be built until it is found convenient or necessary to do so. But whatever parts of it are undertaken should be made of the ultimate cross-section required, and all parts, at least between the New Canal and St. Bernard avenue, should be lined when they are constructed.

Lining of canals, etc.

In general, all canals, branches and drains between the river and the Main Canal, should be lined with Masonry, and many of them covered with the street pavements; but those between the Main Canal and the Lake may be left without lining for years to come.

Between Main Canal and Lake.

The enlargement of existing canals between the Main Canal and the Lake, as well as the cutting of new ones, or their subsequent enlargement, can mostly be done with dredging machinery, and the total cost should not be increased by undertaking the work in instalments, that is, by opening up canals of moderate sizes at first, and afterwards enlarging them.

Between Main Canal and River.

Canals and drains between the Main Canal and the river should, in general, be lined as they are built, though the covering of the larger ones may be omitted without impairing their efficiency as drains. In some cases, where they occupy narrow streets, the absence of covering would result in considerable public inconvenience and, in a few instances, might leave such streets useless as avenues of travel, which, presumably, could not long be tolerated. It would, therefore, appear proper to prosecute the work on most of the canals and other conduits between Broad street and the river, under specifications requiring them to be lined and covered; and the estimates hereinafter presented contemplate such lining, except in certain specified cases, and the covering of all drains between Claiborne street and the river, with certain others mentioned.

Bridges not a part of the plan.

It will of course be necessary for public convenience to build bridges at numerous points across all uncovered canals and branches, but as this work should not in any way increase or diminish the capacity of the channels for drainage, it is considered as forming no essential part of the plan, and its cost is not included in the estimates.

Care should be taken that whatever bridges are built shall not obstruct the free flow of the Canals, and as far as possible all bridges crossing the larger Canals and Branches, especially on the Lake side of the Main Canal, should be so constructed as to facilitate the passage of dredge boats.

Pumping plant of full capacity not required at first.

Since the run-off which the drains and branches are separately designed to carry cannot be expected to reach the pumping stations to which they are tributary simultaneously with full volumes, it follows, as already stated, that the maximum capacity of the plant at any station may be less than that which would be required to pump the

sum of the several rates of run-off which may be delivered into the Main Canal. The pumping plant as first installed, therefore, need not be of full aggregate capacity, and for the further reason that, until larger areas of the city are paved and improved the ultimate capacity cannot be called for, even though the entire system of canals and drains were complete, and, also, that it cannot be presumed that the entire plan will be put under construction at once, or that its execution, even when undertaken, will be completed so rapidly as to make the full-powered plant an early necessity.

Pumps to be installed as found necessary.

It would appear to be good policy to install pumping plants at most of the stations, only as fast as it may be found necessary to keep pace with the construction of the canals, drains, etc., as they are undertaken. The stations should be so designed that pumps comparatively small in capacity, or in number, may be effectively installed at first, and subsequently increased in capacity or number as occasion arises, and to any required extent.

For reasons stated on page 36, the estimates hereinafter presented include provision for a Pumping Plant of a capacity to discharge approximately two-thirds of the aggregate of maximum run-offs for which the drains and canals are designed; but the instalment of the plant to any such extent cannot be recommended until experience proves its necessity.

Work should begin in the second section.

That part of the Second Section lying between Broad street and the river, on account of the concentration there of improved properties, paved streets and business houses, and of its central position with reference to the most densely inhabited area of the city, is now more urgently in need of improved drainage than other localities, and it is evident that the benefits to be derived from the execution of the plan, would be of greater immediate public value there, than in any other section of the city. It hence suggests itself that this section may properly receive the first attention in the prosecution of the work, and a special estimate of cost has accordingly been prepared for it, so that, in case the City Council should desire to undertake this work, before arranging for the execution of other parts of the plan, it may proceed intelligently.

The relative order of importance, for the execution of the several parts proposed in the Second Section, is as follows:

1st. The construction of the Pumping Stations, Nos. 2 and 7, with the improvement of the Relief Branch Canal connecting these Stations.

Order of importance in the second section.

2d. The construction of the St. Louis Branch Canal with lining and covering, or the acquirement and adaptation of the Carondelet Navigation Canal for drainage purposes south of Broad street.

3d. The Main and Branch Drains between Broad street and the river, to be lined and covered.

4th. The improvement of street grades and gutters. Such improvements, however, should not be delayed on account of the non-completion of other parts of the work, though it can accomplish little of itself in the way of drainage, except to relieve one locality by flooding another.

5th. The improvement of the Orleans Relief Outfall Canal.

6th. The construction of Main and Branch Drains between Broad street and the lake.

7th. The construction of the Main Canal and its connection with the sections above and below.

The work in other sections may be prosecuted in any order, or at any time, as it may be found most convenient. Whatever is done towards carrying out the plan in any section, cannot be injurious to the interests of other sections, whether or not they are directly benefited.

Work in other sections.

The First Section has the largest area, and, at present, its tendency towards increase in population and improvement, is probably more apparent than that of the other sections. But whether or not this tendency will continue as notably in the future as in the past cannot be predicted. A part of the drainage under existing arrangements, is discharged into the New Orleans Navigation Canal, a condition of affairs which will probably require change, and some work under the new plan may soon be demanded for that purpose.

The work in the Algiers Section, on account of its comparatively small size and cost might be done with less means than would suffice for much effective work in other sections, and hence might be undertaken at an early date.

In the Third, Fourth and Fifth Sections, the situation and conditions are so similar, as to offer, at this time, no suggestion of priority in date, or of limit in the extent to which work should be undertaken.

PART VI.

ESTIMATES OF COST.

Your Committee has considered it expedient to prepare two estimates. The first is for the whole area to be drained, and for the ultimate and entire completion of the system, with provisions for any extension or improvement that may be required during the next fifty years. The cost of each section is estimated separately. In the First Section, the canals and drains on the River-side of Claiborne Street are lined, while the Claiborne Canal and all canals and drains in the rear of it are unlined. In the Second and Third Sections the Main Canal on Broad Street and all canals and drains on the River-side thereof are lined, and all on the Lake-side are unlined. In the Fourth Section all canals and drains on the River-side of Claiborne Street are lined, while the Claiborne Canal and all canals and drains on the Lake-side thereof are unlined. In the Fifth Section all canals and drains are unlined. In Algiers the Eliza and Vallette street drains are lined. The other canals and drains in this section are unlined.

The second estimate is for carrying out the recommendations made on Page 41, namely for the early improvement of parts of the Second Section to an extent which may be within the present financial ability of the city.

APPROXIMATE ESTIMATE OF COST OF DRAINAGE SYSTEM.

No. of Sections	Canals and Drains.		Main Canal.		Out-Fall Canals.	Pumping Stations.		Total Cost.
	Lined.	Unlined.	Lined.	Unlined.	Unlined.	Main.	Auxiliary	
First ..	$1,001,062	$378,365	$	$124,425	$15,000	$125,000	$312,500	$2,856,352
Second..	850,310	212,676	300,000		23,000	120,000	287,500	1,793,486
Third ..	465,294	143,212	390,000		14,000	118,750	231,250	1,362,506
Fourth	233,037	51,786	534,000		10,000	196,250		1,025,073
Fifth ..		79,048		139,356	50,000	475,000		744,304
Algiers	49,500	43,720				58,750		151,970
Total..	$3,499,203	$909,707	$1,224,000	$263,781	$112,000	$1,093,750	$831,250	$7,933,691

Approximate Estimate of Cost for the Improvement of the Second Section as recommended:

First. Pumping Stations Nos. 2 and 7	$300,000
Second. Construction of all Branch Canals, Main Drains and Branch Drains, on River-Side of Broad Street, Lined and Covered	850,310
Third. Improvement of Relief Branch Canal, between Pumping Stations Nos. 2 and 7	128,000
Fourth. Improvement of Orleans Relief Out-Fall Canal, between Pumping Station No. 7 and the Lake	23,000
Total cost	$1,301,310

Respectfully submitted,

B. M. HARROD, Chairman, New Orleans,
HENRY B. RICHARDSON, New Orleans,
RUDOLPH HERING, New York,
Engineering Committee.

April 18, 1895.

THE SURVEYS, LEVELING, RAIN-FALL and DISCHARGE GAUGINGS,

COMPUTATIONS, MAPPING, Etc.,

WERE EXECUTED BY THE

Topographical Survey Department,

UNDER THE DIRECTION OF

L. W. BROWN, City Engineer.

Engineering Staff:

A. R. LITTELJOHN, 1st Asst. Engineer,
W. C. KIRKLAND, . Assistant Engineer,
A. L. BLACK, ... „ „
W. T. CROTTS, . . . „ „
E. L. LAMBERT, . . „ „
J. F. DUPUY, ... „ „
A. F. THEARD, . . . Draughtsman,
B. SHALL, ... Computer.

APPENDICES.

APPENDIX I.

DEFINITIONS AND DESCRIPTIONS OF NAMES AND TERMS

APPLIED TO DIFFERENT PARTS OF THE WORK.

"DRAINAGE DISTRICTS" refers to the sub-divisions of the city with reference to the existing drainage system, as shown on Plate III. The city is now divided into three districts, known as the First, Second, and Third Drainage Districts.

"DRAINAGE SECTIONS" refers to the proposed sub-divisions of the city into drainage areas, and conforms to the proposed drainage plan, as shown on Plate IV. There will be six of these sections, to be known as the First, Second, Third, Fourth, Fifth and Algiers Sections. The area comprised in each section being that which will be drained by each of the five Main Pumping Stations, located on the Main Canal, as also one in Algiers.

The Draining Machines of the present system are five in number. They are designated by the names London, Orleans, Bienville, Melpomene and Dublin, and are located as shown on Plate III.

The Pumping Stations of the proposed system are nine in number, and are known as No. 1, located on Broad street, at the New Orleans Navigation Canal; No. 2, located at the intersection of Broad and St. Louis streets; No. 3, located at the intersection of Broad street and St. Bernard Avenue; No. 4, located at the intersection of Florida Avenue and Lafayette Avenue; No. 5, located at the intersection of Jourdan Avenue and Florida Avenue; No. 6, an auxiliary station, located at the intersection of Metairie Ridge and Upper Protection Levee; No. 7, an auxiliary station, located at the intersection of Taylor avenue and Orleans street; No. 8, an auxiliary station, located at the intersection of London and Monroe Avenues, and No. 9, located at the intersection of Canal avenue and Lawrence Street, in the Algiers Section.

"CAIRO DATUM," abbreviated "C. D." refers to a plane 21.26 feet below Mean Gulf Level, and is the datum to which all elevations are referred.

"MAIN CANAL" refers to the proposed Canal on Broad street, Hope street, and Florida Avenue from the Intersection of Nashville Avenue and Claiborne street to Pumping Station No. 5.

"BRANCH CANALS" refers to all Canals discharging direct into the Main Canal.

"MAIN DRAINS" refers to conduits discharging into the Branch Canals.

"BRANCH DRAINS" refers to conduits discharging into Main Drains.

"RELIEF BRANCH CANALS" refers to those Canals which lead from the Pumping Stations, located on the Main Canal, to the Auxiliary Stations, and which are used for a double purpose, namely, as Branch Canals during dry weather, and light storms, discharging into the Main Canal, and as Relief Canals during heavy storms, delivering the water to the Auxiliary Pumping Stations.

"MAIN OUTFALL CANAL" refers to the Canal delivering the water from the Pumping Station on Florida Avenue at the intersection of Jourdan Avenue to the Bayou Bienvenu.

"RELIEF OUTFALL CANALS" refers to the Canals delivering water from the three Auxiliary Pumping Stations, as also from Station No. 4 to Lake Pontchartrain.

"STREET GUTTERS" refers to the small conduits, which may be covered or uncovered, collecting the water from the street and discharging into the Branch Drains.

"RUN-OFF" refers to the rate of delivery of precipitation into the Canals and Drains.

"The RUN-OFF CURVES" on Plate VIII show in cubic feet per second, the volume of the run-off which the proposed system is designed to effectively handle, from surfaces having different areas, slopes and density of population.

The word "ZONE," where used in connection with this report, refers to the comparative impermeability of the surface of the ground.

"ZONE A," refers to the densely improved sections, such as the territory embraced between the River, Rampart, Toulouse and Delord streets.

"ZONE B," refers to a territory of medium density as to improvements, such as is embraced between Washington, Felicity, the River and St. Charles streets.

"ZONE C," refers to sparsely built territory where the houses are surrounded by large yards with little or no pavement, such as the territory between Washington Avenue, Audubon Park, the River and St. Charles street.

"ZONE D," refers to rural or agricultural areas such as Audubon Park, or farming lands.

The word "NORMAL," as used in this report, for drainage discharge, refers to the conditions existing when little or no rain-fall occurs.

APPENDIX II.

STATEMENT OF MEASURES WHICH HAVE BEEN TAKEN, FROM TIME TO TIME, RELATIVE TO THE IMPROVEMENT OF THE DRAINAGE OF THE CITY OF NEW ORLEANS, AND A DESCRIPTION OF ITS EXISTING CONDITION.

At different times during the past forty years, efforts have been made towards the proper drainage of the city; but, with the exception of the work done between the years 1871 and 1873, nothing of any permanent value, or of a nature embracing the completion of any comprehensive or general system, has been executed. From this fact, in connection with a brief review of our present condition, the conclusion is most apparent that the improvement in the drainage of the city has not been co-extensive with its commercial growth.

The earliest report on the subject of drainage, is that of the City Surveyor, Mr. Louis H. Pilié, to the Common Council, in 1857, which treats wholly of the improvement of the drainage of that portion of the city lying to the rear of Claiborne street. This report recommended the construction of a number of open canals for drainage, and of levees to protect the city from inundation by the lake. The report is not accompanied by any plan, and does not clearly state what disposal of the drainage he proposed, or what locations were chosen at that time for the machinery, necessary for lifting the water. It is, however, quite apparent that it was Mr. Pilié's idea to deliver the drainage into Lake Pontchartrain. Previous to the date of Mr. Pilié's report, the Legislature of the State of Louisiana had taken steps towards the drainage of the rear portion of the city, as will appear from the following quotation from his report:

"I might say, *en passant*, that an appropriation by our last Legislature of five thousand dollars to pay two engineers to make a survey of the swamps in the rear of the city, and report on the advisability of draining same, amounts to a useless expenditure of public money."

No record is at hand to show that any practical results were obtained from the survey referred to.

The benefits that would accrue from the thorough drainage of the whole area occupied by the city, were appreciated forty years ago fully as much as now, as will appear by the following quotation from the same report:

"When the drainage of our swamps shall be perfected, our city will rank among the healthiest of the world. The growth and population of our city will rapidly appear, our commerce will be largely benefited. our population, far from seeking a residence during the summer and sickly months, will remain in the city and erect delightful residences along the lake shore, and upon the now swamp lands of our city, and thus a large amount of property, at present valueless, will amount to millions and swell our assessment rolls."

The Legislature in 1858, 1859, 1861 and 1871, enacted laws relative to the drainage of the City of New Orleans.

Act No. 165 of the Legislature of 1858, relates to the dividing of the city into four drainage districts, and providing a commission for each district; and, also a mode of assessment for the operation of the same.

Act No. 179 of 1859 of the Legislature, amends Act No. 165 of 1858, by authorizing the issue of thirty year bonds, limiting the issue to $350,000 for any one of the four districts.

Act No. 57 of 1861 provides for the collection of assessments for drainage purposes.

Act No. 30 of 1871, authorizes a contract to be entered into by the City of New Orleans, with the Mississippi and Mexican Gulf Ship Canal Company, for the construction of levees to protect the city from overflow, and of canals and pumping machinery for the drainage of the city, the location of the levees and canals to be as may be determined by the administrators of the affairs of the city. This Act authorizes that the rate of charge for the work performed shall be fifty cents per cubic yard for all canals excavated, and fifty cents per cubic yard for all levees built.

In 1868, the City Surveyor, Mr. L. Surgi, submitted to the Common Council a report relative to the drainage of the city. This report recommended the improvement of the existing condition of drainage by the construction of additional open canals, and improving the machinery. It does not contain any data as to the volume of water to be handled, or the point of outfall. In fact, the report merely recommends the enlargement and improvement of the existing canal system and drainage machines. In his report, Mr. Surgi refers to Lake Borgne and Bayou Bienvenu, as follows:

"Bayou Bienvenu empties into Lake Borgne and is one of the main natural drains of the lower section of the city from Esplanade street down."

With a view of perpetuating historical matter, the following is quoted from Mr. Surgi's report:

"As early as March, 1835, a charter was granted for a period of twenty years to "the New Orleans Draining Company. Its object was to drain and reclaim, by "means of canals and ditches, the land comprised between the upper limits of "Suburb Livaudais, the line of the New Canal to Lake Pontchartrain, along the "shore of said lake to Bayou Cochon, in a straight line to Fisherman's Canal, "down thence to the Mississippi River."

In 1869, the Common Council, by Ordinance No. 1148, N. S., elected a Board of Engineers to mature and recommend some general plan for the present and future drainage of the City of New Orleans. This Board was composed of Messrs. Braxton Bragg, A. G. Blanchard, Richard J. Evans, John Roy, H. C. Brown, G. W. R. Bayley, L. Surgi, and J. A. D'Hémécourt. This Commission recommended, for immediate relief, the improvement of the drainage system as recommended in Mr. Surgi's report in the year previous, and above referred to: but added that the ultimate plan of drainage, should be by means of underground sewers, collecting the water and delivering into the river. This report was evidently compiled without any accurate knowledge either of the topography, or of the volumes of water to be handled. While it would not be impossible to collect the storm-waters in sewers and deliver the same to the river, it would be impracticable.

The work done by the Mississipppi and Mexican Gulf Ship Canal Company in 1871, 1872 and 1873, under provision of Act No. 30, of 1871, was carried out

under the direction of the City Surveyor, Mr. W. H. Bell, and was in accordance with what is known as the "Bell Plan." There is no complete description of the system as proposed by Mr. Bell to be found, but from such records as are available, it is evident the system proposed by him was for the delivery of the drainage of the main portion of the city directly into Lake Pontchartrain. Part of the system contemplated the construction of a substantial breakwater and levee along Lake Pontchartrain from the Upper Protection Levee to People's Avenue Canal, and locating along this revetment, the necessary pumping machinery to lift the water into the lake. It is also conclusively shown that Mr. Bell contemplated the repumping of the water, from the area of the city between the river and the ridge, in order to provide the necessary slope for its delivery through canals of practicable size, to the machines placed at the lake for final disposal. Mr. Bell recommended Lake Borgne as the ultimate out-fall of all the foul drainage of the city. His views on the subject of the ultimate disposal of the drainage of the city, as also on the delivery of the water to the machines located on the shore of Lake Pontchartrain, are fully set forth in the following letter:

To the Editor of the Times-Democrat:

NEW ORLEANS, Dec. 31, 1894.

During the discussion of the two plans for the drainage of the city now before the Council, I have seen it several times stated in print that the plan of drainage formulated by the committee on water and drainage is the system designed by my father, the late W. H. Bell. I admit that the present system of canals were designed by him and partly completed under the Mexican Gulf Canal Company drainage bill; but I most emphatically deny that he ever intended to make the mistake of depending on a single line of draining machines, located at the lake and at the head of Bayou Bienvenu, for the drainage of the city. The following quotations from his printed correspondence and reports are submitted to substantiate my denial:

"SURVEYOR'S OFFICE, Room No. 19, City Hall,
"New Orleans, June 17, 1871.

"Hon. John Cockran, Administrator of Improvements:

"Dear Sir—In my reports to you I have confined my suggestions and estimates entirely to the main reservoirs and protective levees. I would now suggest that in the location of pumping machinery, it be placed with a view to the ultimate division of the city into urban and suburban drainage, the urban drainage to be conveyed by sewers or large iron pipes, below the city into Bayou Bienvenu, the pipes passing under the navigation canals. The suburban drainage to be emptied into Lake Pontchartrain. The first step toward a system of drainage is to prevent overflow from the Mississippi river and Lake Pontchartrain. The location of this machinery becomes a secondary consideration. Respectfully, etc. W. H. BELL, City Surveyor."

The great error many persons fall into, is the idea that the drainage of this city can be drawn from the river bank and thrown into the lake by a single line of draining machines placed upon the lake shore. A practical objection arises in the fact that the land is comparatively flat for a distance of three miles (excepting the Metairie ridge) and in some places four miles, which great distance admits of no down grade or fall in the bottom of the canal. All the present canals are about level on the bottom, the fall being created by the action of the draining wheels upon the surface. Consequently, there is no current or action of water upon the bottoms of the canals, hence the great deposit near the thickly settled portions of the city. A single line of draining machines placed at the lake to drain from the river, or to drain from intermediate lines of machines, would require to be very powerful and great dip of wheel (to secure a current on the bottom of the canals), consequently a great weight of foundation and machinery, which is difficult to construct substantially upon that soil. By having three lines or divisions the breaking of machinery or caving of levee does not necessarily cause a general overflow.

The above communication outlines a system of drainage which in its main points is the same as that outlined by the Advisory Board of Engineers in their preliminary report to the City Council. It also shows very conclusively that my father, upon a thorough investigation of the subject had become convinced that the only way to thoroughly and rapidly drain the city was by rehandling the water, or in other words, the system must be cumulative. To sustain his position on this point I append a quotation from a communication to Mayor Benjamin F. Flanders, by G. W. R. Bayley, civil engineer, in his discussion of the drainage problem at that time:

"The location of the draining machines along the lake shore will not enable us to dispense with the present draining machines. To the contrary, additional machines will be needed, and are now needed, between the foot of the slope from the river and the Metairie ridge, as well as upon the ridge. It, of course, must rise at the foot of the first slope, until the head is sufficient to give a current strong enough to carry off the water as fast as it comes down the slope from the river. This rise during heavy rains, without draining machines at and on the river side of the ridge, would cause the overflow of the city from Claiborne or Galvez street to the ridge, if we had no matter how many draining machines on the lake shore. Draining machines and canals give an artificial slope down a series of inclines." Respectfully,

A. C. BELL, Civil Engineer.

In 1881, a communication was addressed to the Honorable Mayor and Administrators of the City of New Orleans by Mr. Joseph Jouet. The plan contemplated the construction of a large central canal, which would act as a main tailrace for all the drainage, to run from the Upper Protection Levee and connect with Bayou Bienvenu, through which all the drainage water of the City of New Orleans would be delivered to Lake Borgne.

In 1889, a plan for the drainage of the City of New Orleans was presented to the City Council by Mr. J. L. Gubernator, which, with some modifications, was submitted by him to the present Advisory Board. The general features of this plan are the delivery of the water into Lake Pontchartrain, the improvement of existing canals, the construction of a large number of additional open canals and the placing of a large number of draining machines.

The plan presented to the Advisory Board by Mr. S. D. Peters, is for the delivery of all the drainage of the city through a main central canal to Lake Borgne. The drainage received from the different areas of the city is to be pumped into this main canal, and the main canal relieved by a pump at its lower end. The general features of the plan presented by Mr. Peters are similar to those contained in Mr. Jouet's plan of 1881.

In 1890, the Orleans Levee Board offered a premium of $2500.00 for the best plan of drainage for the City of New Orleans. The only data which they could furnish those who desired to enter this competition, was a general plan of the city. No exact knowledge could be given as to topography, areas, hydrography, or other data essential for the formulation of an efficient plan. Although there were several plans submitted in response to the advertisement, none could be accepted, for the reason that there was no reliable knowledge of the factors which were essential in determining the value of any of the plans submitted.

The necessity of making investigations relative to the topography and hydrography of the city, for the purpose of formulating a plan of drainage, has long been appreciated and, in 1888, an endeavor was made in the Legislature to pass an act enabling this preliminary work to be executed. The City Engineer, B. M. Harrod, made strenuous efforts to secure the necessary funds from the City Council, but without success. An attempt to obtain the funds by private subscrip-

tion from public spirited citizens, also failed, and no measures looking towards the execution of this very essential preliminary work, were adopted until September, 1892, when an ordinance was introduced in the Council appropriating, $17,500.00 for the purpose. This step met with considerable opposition, principally due to the supposition that the investigation had been made by previous administrations, and that the data could be found. A rigid search was made for records of this nature, but without result. The necessity for obtaining this information was demonstrated to the Council, and the ordinance authorizing the work, and providing the funds therefor, was adopted by it in February, 1893. The work was inaugurated thereafter, with as little delay as possible.

As shown in the above statement of the various attempts that have been made relative to the improvement of the drainage of the City of New Orleans, no work of any magnitude has been done since 1872 and 1873, under what was known as the "Bell Plan."

As stated in the body of the report, the Canals and Draining Machinery have not sufficient capacity to deliver the water to the out-falls with such rapidity, as to avoid the inundating of large and valuable areas; in fact, the investigations which have been made show, that when working at their maximum capacity they are capable only of properly disposing of the run-off from 1-100 of an inch rain-fall in 5 minutes, or 12-100 in one hour, which, in comparison to storms such as visited the City of New Orleans on August 13, 1894, is entirely inadequate. The water from this storm remained on a large territory of the city for a period of 72 hours before the existing machinery, working at its full capacity, removed same.

The existing system of drainage is composed, as stated in the body of the Report, of open canals receiving the water delivered from the higher portions of the city by the small street gutters, and conveyed by these open canals to the draining machines, which deliver the same into Lake Pontchartrain. These draining machines are four in number, and are located in the bottom of the basin between the river and the Metairie and Gentilly Ridges, excepting the London draining machine, which is located on Gentilly Ridge.

The Dublin draining machine is located at the intersection of 14th and Dublin streets, and has a maximum capacity to deliver 480 cubic feet of water per second, with a lift of five feet. This machine is composed of two wheels, one being 34 feet in diameter and 6 feet face and the other being 34 feet 4 inches diameter, with a face of 5 feet 9 inches.

The Melpomene draining machine is located at the intersection of Claiborne and Melpomene streets, and has a maximum capacity to deliver 150 cubic feet of water per second, with a lift of 5 feet. This machine has only one wheel, which is 35 feet diameter, 4 feet 6 inch face.

The Bienville draining machine is located at the intersection of Hagan Avenue and Toulouse street, and has a maximum capacity to deliver 240 cubic feet of water per second, with a lift of 5 feet. This machine consists of two draining wheels, one being 28 feet 6 inches in diameter, 4 feet 4 inches face, and the other 34 feet in diameter and 7 feet face.

The London draining machine is located at the intersection of London Avenue and Gentilly Ridge, and has a maximum capacity to deliver 300 cubic feet of water per second, with a lift of 5 feet. This machine consists of two draining wheels, each of which is 35 feet in diameter and 4 feet 10 inches face.

There is located at the intersection of Bayou St. John and Orleans streets a centrifugal pump, delivering into the lake through the same tail-race as the Bienville machine. This pump has a maximum capacity of 44 cubic feet of water per second, with a lift of 5 feet.

The area of the city now drained is divided into three districts by the two Navigation Canals.

These districts are known as first, second and third, and embrace an aggregate of 13,357 acres. The location of these districts, as also of the draining machines, is shown on Plate III.

The area of the city now drained extends only from the River to the Metairie and Gentilly Ridges, and a portion of this territory is wholly undrained and other portions, of considerable area, are but partially drained.

The first drainage district embraces that portion of the city between the River, Metairie Ridge, the two Navigation Canals, Julia and Toulouse streets and has an area of 2,170 acres which is tributary to the Bienville draining machine.

The second district embraces that portion of the city between the River, Metairie Ridge, Upper Protection Levee, New Orleans Navigation Canal and Julia street, and has an area of 7,709 acres which is tributary to the Dublin and Melpomene draining machines.

The third district embraces that portion of the city between the River, Gentilly Ridge, Carondelet Canal, Bayou St. John, Toulouse and Elysian Fields streets, also between Elysian Fields and Poland streets from the River to Claiborne street, aggregating an area of 3,470 acres, which is tributary to the London draining machine and the Orleans pump.

The section of the city known as Algiers, situated on the right bank of the river, has no drainage system.

As above noted, the total area of the city on the left bank of the river now drained has an aggregate area of 13,357 acres, which, as shown, is very imperfectly drained, and is about one-half of the area which the plan proposes to thoroughly drain, the aggregate area of which is 24,932 acres including Algiers.

The draining machinery, with the exception of the Orleans pump, has been in service for upwards of forty (40) years, and is consequently primitive and not economical in its operation.

Considering the matter from every point, our present situation as to drainage in conjunction with the topographical and hydrographical conditions, renders the formulating of a thoroughly efficient and comprehensive system of drainage for the city an unique and intricate problem, and, perhaps, is unparalleled in this country or Europe, and the solving of the problem renders absolutely necessary a most careful and rigid investigation into all of the conditions bearing on the subject.

APPENDIX III.

TOPOGRAPHICAL SURVEY.

The topographical survey was started in July, 1893. The preliminary work had been well advanced, when, on September the 8th, it was stopped by an injunction issued by the Civil District Court, and not resumed until about the middle of December, 1893, since which time it has proceeded uninterruptedly, all the field-work being completed about the first of January, 1895.

A complete survey of the city has been made, and embraces the area bounded by the Mississippi River, Lake Pontchartrain, the Upper Protection Levee, People's Avenue Canal from Lake Pontchartrain to Florida Avenue, Florida Avenue from People's Avenue to the lower limits of the city, and the latter from Florida Avenue to the Mississippi River, and also the principal portion of Algiers. This survey was made by the establishment of carefully measured base lines around and within the area. The lines which have been traversed aggregate more than one hundred and fifty miles in length, and are as follows:

A line around the entire area on the left bank, as above described.

A line on Washington street, from the River to Carrollton avenue.

A line on Carrollton avenue, from the River to Metairie Ridge, near the Lower City Park, and extending to and crossing Bayou St. John at Marigny avenue, thence down and along Marigny avenue to Elysian Field street, and thence to the intersection of Florida Avenue and People's Avenue Canal.

A line on Tenth and Claiborne streets, commencing at the Upper Protection Levee and extending throughout the whole length of Claiborne street to Poland street.

A line on Elysian Fields street, from the River to the Lake.

A line on Broad street, from Julia street to Marigny avenue.

A line on Esplanade avenue, from the River to Bayou St. John.

A line on London avenue, from Marigny avenue to the Lake.

A line on St. Peter street, from the River to Carrollton avenue, thence along the Orleans Tail-race to the Lake.

A line on Julia street, from the River to Rampart street, and thence along the New Orleans Navigation Canal to the Lake.

A line on Seventeenth street, from Carrollton avenue to Metairie Ridge and thence along Metairie Ridge from the Upper Protection Levee to Esplanade avenue.

A line on St. Charles avenue, from Carrollton avenue to Julia street.

A line on St. Claude street, from Elysian Fields street to the lower limits of the city.

A line on Felicity Road, from the River to Claiborne street, and thence along the Melpomene Canal to the intersection of Washington Shell Road.

A line on Lowerline street, from the River to Claiborne street.

A line on Walnut street, from the River to Ouachita street.

A line on Claiborne street, from the River to St. Charles avenue.

A line on Webster street, from the River to St. Charles avenue.

A line on Henry Clay avenue, from St. Charles avenue to Claiborne street.
A line on Peters avenue, from the River to Hector street.
A line on Joseph street, from the River to St. Charles avenue.
A line on Octavia street, from St. Charles avenue to Arcadia street.
A line on Valmont street, from the River to Breslau street.
A line on Upperline street, from the River to Breslau street.
A line on Milan street, from St. Charles avenue to Claiborne street.
A line on General Taylor street, from the River to St. Charles avenue.
A line on Amelia street, from the River to Claiborne street.
A line on Delachaise street, from the River to Claiborne street.
A line on Toledano street, from the River to Claiborne street.
A line on Harmony street, from the River to Magnolia street.
A line on First street, from the River to St. Charles avenue.
A line on Philip street, from the River to Claiborne street.
A line on St. Andrew street, from the River to Claiborne street.
A line on Lafayette avenue, from the River to Josephine street.
A line on Lafayette street, from the River to Claiborne street.
A line on Adams street, from the River to St. Claude street.
A line on Delery street, from the River to St. Claude street.
A line on Camp street, from Felicity Road to Delord street.
A line on St. Thomas street, from Robin street to Delord street.
A line on Robin street, from the River to St. Thomas street.
A line on Delord street, from St. Thomas street to Claiborne street.
A line on Locust street, from Lafayette street to Common street.
A line on Liberty street, from Julia street to Tulane avenue.
A line on Galvez street, from Julia street to St. Peter street.
A line along London Avenue Tail-race, from the Upper Protection Levee to the London Avenue Draining Machine.
A line on St. Bernard avenue, from Claiborne street to Treasure street.
A line on Taylor avenue from Orleans street to Bayou St. John.
A line on Harrison avenue, from Orleans street to Bayou St. John.

A line was run along Gentilly Road, as also on the right bank (Algiers side) of the river from the nine mile point opposite Carrollton to Webster avenue below the Southern Pacific Railroad Depot. Also the necessary lines in Algiers to make a complete survey of same. The notes of all these surveys have been calculated by means of Latitude and Departure and plotted. All the note books of this work are indexed and filed.

Where necessary, off-set lines from these traverse lines were made to enable a thoroughly correct map of the city to be plotted.

The entire city has been leveled over, bench marks were established at convenient points, and a record of the location and elevation of the same registered in a book of bench-marks. The whole work refers to Cairo Datum.

The leveling consisted in the main, of running each leading street and obtaining the elevation of the curb, gutter, center of street and property line at intersections, and in center of block, as also the elevation of the tops of all culverts, bridges and steam and street railroad tracks at intersections.

Lines on all of the existing drainage canals and tail-races were run, and the elevations obtained of the surface of the ground adjacent to the bank, the surface of the water and the bottom of the canals.

Profiles of all leading streets have been plotted and the originals carefully indexed and filed.

The following is a list of the profiles made:

Adams (now Alabo) Street, from the River to Claiborne street, 3d District.
Adams Street, from the River to Tenth street, 7th District.
Adele Street, from River to St. Thomas street, 4th District.
Aline Street, from Tchoupitoulas street to St. Charles avenue, 6th District.
Amelia Street, from Front street to Clara street, 6th District.
Anthonia Street, from St. Claude street to Marigny avenue, 3d District.
Antonine Street, from Tchoupitoulas street to St. Charles avenue, 6th District.
Andry Street, from the River to St. Claude street, 3d District.
Arts Street, from Urquhart street to Claiborne street, 3d District.
Aubrey Street, from Tonti street to Gentilly Road, 3d District.
Audubon Street, from Water street to Claiborne street, 6th District.
Austerlitz Street, from the River to Perrier street, 6th District.
Arabella Street, from the River to St. Charles avenue, 6th District.
Anthonia Street, from Marigny avenue to Gentilly Road, 3d District.
Alexander Street, from the River to Villere street, 3d District.
Atlantic Avenue, from Patterson street to Lapeyrouse street, 5th District.
Banks Street, from Prieur street to Murat street, 1st District.
Barracks Street, from the River to Broad street, 2d District.
Bartholomew Street, from the River to Claiborne street, 3d District.
Baudin Street, from Broad street to Murat street, 1st District.
Bellecastle Street, from the River to Perrier street, 6th District.
Bellechaise Street, from Tchoupitoulas street to St. Thomas street, 1st District.
Berlin Street, from the River to Claiborne street, 6th District.
Bienville Street, from the River to Metairie Ridge 2d District.
Bordeaux Street, from the River to St. David street, 6th District.
Broadway Street, from the River to Tenth street, 6th District.
Bourbon street, from Canal street to Marigny avenue, 2d and 3d Districts.
Broad Street, from Julia street to Toulouse street, 1st and 2d Districts.
Broad Street, from Esplanade avenue to Lapeyrouse street, 3d District.
Burdette Street, from the River to Tenth street, 7th District.
Burgundy Street, from Canal street to Poland street, 2d and 3d Districts.
Bourbon Street from Marigny avenue to Gentilly Road, 3d District.
Bolivar Street, from Lafayette street to Tulane avenue, 1st District.
Bruxelles Street, from St. Bernard avenue to Gentilly Road, 3d District.
Basin Street, from Julia street to Toulouse street, 1st District.
Benjamin Street, from Audubon Park to Eleonore street, 6th District.
Bartholomew (now Bermuda) Street, from Levee street to Eliza street, 5th Dists.
Bringier Street, from Madison street to Chestnut street, 5th District.
Bouny Street, from Levee street to Market street, 5th District.
Cadiz Street, from the River to Claiborne street, 6th District.
Caffin's Avenue, from the River to Claiborne street, 3d District.
Calhoun Street, from Tchoupitoulas street to St. Charles avenue, 6th District.
Calliope Street, from the River to Claiborne street, 1st District.
Canal Street, from the River to Metairie Road, 1st and Second Districts.
Celeste Street, from South Peters street to Felicity Road, 1st District.
Chartres Street, from Canal street to Esplanade avenue, 2d District.
Chippewa Street, from Felicity Road to Louisiana avenue, 4th and 6th Districts.

Clio Street, from Camp street to Claiborne street, 1st District.
Clouet Street, from the River to Claiborne street, 3d District.
Commercial Place, from Camp atreet to St. Charles street, 1st District.
Common Street, from the River to Protection Levee, 1st District.
Columbus Street, from Rampart street to Broad street, 3d District.
Conery Street, from Prytania street to Carondelet street, 4th District.
Congress Street, from the River-to Claiborne street, 3d District.
Constantinople Street, from Front street to St. Denis street, 6th District.
Conti Street from the River to Bernadotte street, 2d District.
Customhouse Street, from the River to Helena street, 2d District.
Cypress Street, from Liberty Street to Galvez street, 1st District.
Carrollton Avenue, from the River to Canal street, 7th District.
Claiborne Street, from Julia Street to Elysian Fields street, 1st, 2d, and 3d Dists.
Camp Street, from Canal street to Napoleon avenue, 1st, 4th and 6th Districts.
Castiglione street, from Broad street to Gentilly road, 3d District.
Clinton street, from Customhouse street to Bienville street, 2d District.
Chestnut Street from Felicity Road to Audubon Park, 4th and 6th Districts.
Constance Street, from Felicity Road to Audubon Park, 4th and 6th Districts.
Canal (now Whitney) Avenue, from Patterson street to Lapeyrouse street, 5th Dist.
Chestnut (now Belleville) Street, from Patterson street to Lapeyrouse street, 5th Dist.
Columbus Street, from Madison street to Verret street, 5th District.
D'Abadie Street, from Galvez street to Gentilly road, 3d District.
Dauphine Street, from Canal street to Delery street, 2d and 3d Districts.
Delachaise Street, from the River to Claiborne street, 6th District.
Delery Street, from the River to Claiborne street, 3d District.
Delord street, from Front street to Lee Circle, 1st District.
Desire Street, from the River to Claiborne street, 3d District.
Deslonde Street, from Royal street to St. Claude street, 3d District.
Dorgenois Street, from Julia street to Toulouse street, 1st and 2d Districts.
Dufossat Street, from the River to Long street, 6th District.
Dumaine Street, from the River to Bayou St. John, 2d District.
Dryades Street, from Delord street to Canal street, 1st District.
Edmund Street (now Calhoun) from St. Charles Avenue to Leonce street, 6th Dist.
Egania Street, from the River to Claiborne street, 3d District.
Eighth Street, from the River to Dryades street, 4th District.
Eleonore Street, from the River to St. Charles Avenue, 6th District.
Elmire Street, from the River to Claiborne street, 3d District.
Elysian Fields Street, from the River to Marigny Avenue, 3d District.
Enghein Street, from the River to Claiborne street, 3d District.
Erato Street, from the River to Claiborne street, 1st District.
Esplanade Avenue, from the River to Bayou St. John, 2d and 3d Districts.
Euterpe Street, from Coliseum street to Liberty street, 1st District.
Elmira Street, from Patterson street to Lapeyrouse street, 5th District.
Feliciana Street, from St. Claude street to Claiborne street, 3d District.
Felicity Road, from Tchoupitoulas street to Claiborne street, 4th District.
First Street, from the River to Claiborne street, 4th District.
Flood Street, from the River to Claiborne street, 3d District.
Forstall Street, from the River to Claiborne street, 3d District.
Foucher Street, from Tchoupitoulas street to Green street, 6th District.
Fourth Street, from the River to Claiborne street, 4th District.

France Street, from the River to Claiborne street, 3d District.
Frenchmen Street, from Esplanade Avenue to Marigny Avenue, 3d District.
Florida Street, from Gentilly Road to Esplanade Avenue, 3d District.
Fourth Street (now Oaks) from Jackson street to Lowerline street, 7th District,
Fortin Street, from Gentilly Road to Mystery street, 3d District.
Franklin Avenue, from Market street to Lapeyrouse street, 5th District.
Gaiennie Street, from Pillie street to Camp street. 1st District.
Galvez Street, from Julia street to Toulouse street, 1st and 2d Districts.
Gasquet Street, from Basin street to Bernadotte street, 1st District.
General Taylor Street, from the River to Claiborne street, 6th District.
Girod Street, from Levee street to North Liberty street, 1st District.
Gordon Street, from Chartres street to Villere street, 3d District.
Gravier Street, from the River to Pierce street, 1st District.
Galvez Street, from Esplanade Avenue to Lapeyrouse street, 3d District.
Hagan Avenue, from Julia street to Canal street, 1st District.
Hancock Street, from the River to Claiborne street, 3d District.
Harmony Street, from the River to Claiborne street, 4th District.
Havana Street, from Miro street to Gentilly Road, 3d District.
Henderson Street, from Water street to Tchoupitoulas street, 1st District.
Henry Clay Avenue, from the River to Claiborne street, 6th Distriet.
Hillary street, from the River to Sixth street, 7th District.
Hospital Street, from the River to Broad street, 2d District.
Howard Avenue, from Lee Circle to Rampart street, 1st District.
Howell Street, from the River to Claiborne street, 3d District.
Hunter Street, from Peter street to Tchoupitoulas street, 1st District,
Hurst Street, from Audubon Park to Joseph street, 6th District.
Independence Street, from Peters street to Claiborne street, 3d District.
Jackson Avenue, from the River to Claiborne street, 4th District.
Jackson Street (now General Ogden), from the River to Tenth street, 7th District.
Jeanne (now Alva) Street, from Peters street to Claiborne street, 3d District.
Jena Street, from the River to Claiborne street, 6th District.
Joseph Street, from the River to St. Charles street, 6th District.
Josephine Street, from the River to Claiborne street, 4th District.
Jourdan Avenue, from the River to Marais street, 3d District.
Julia Street, from the River to Galvez street, 1st District.
Kerlerec Street, from Dauphine street to Dorgenois street, 3d District.
Kentucky Street, from the River to Villere street, 3d District.
Lafayette Street, from the River to Galvez street, 1st District.
Lafayette avenue, from St. Bernard Avenue to Broad street, 3d District.
Laharpe Street, from London Avenue to Gentilly Road, 3d District.
Lapeyrouse Street, from Claiborne street to Gentilly Road, 3d District.
Leonidas Street, from the River to Tenth street, 7th District.
Leontine Street, from the River to St. Charles street, 6th District.
Lesseps Street, from the River to Claiborne street, 3d District.
Lizardi Street, from the River to St. Claude street, 3d District.
London Avenue from St. Bernard Avenue to Broad street, 3d District.
Louisa Street, from the River to Claiborne street. 3d District.
Louisiana Avenue, from the River to Claiborne street, 6th District.
Lowerline Street, from the River to Tenth street, 7th District.
Lyons Street, from the River to Pitt street, 6th District.

London Avenue, from Marigny Avenue to Gentilly Road, 3d District.
Laurel Street, from Louisiana Avenue to Audubon Park, 6th District.
Lawrence Street, from Levee street to Chestnut street, 5th District.
LeBoeuf Street, from Patterson street to Eveline street, 5th District.
Madison (now Dante) Street, from the River to Tenth street, 7th District.
Mandeville Street, from the River to Galvez street, 3d District.
Market Street, from Water street to Felicity Road, 1st District.
Marigny Street, from Levee street to Prieur street, 3d District.
Mazant Street, from the River to Claiborne steeet, 3d District.
Melpomene Street, from St. Thomas street to Claiborne street, 1st District.
Milan Street, from Front street to Claiborne street, 6th District.
Miro Street, from Julia street to Toulouse street, 1st and 2d Districts.
Monroe (now Tupelo) Street, from the River to Claiborne street, 3d District.
Music Street, from Burgundy to Celestine street, 3d District.
Montegut Street, from the River to Claiborne street, 3d District.
Marengo Street, from the River to Claiborne street, 6th District.
Magazine Street, from Canal street to Audubon Park, 1st, 4th and 6th Districts.
Maurepas Street, from Gentilly Road to Esplanade Avenue, 3d District.
Murat Street, from Canal street to Orleans street, 2d District.
Madison Street (now Brooklyn Avenue), from Bringier street to Copernicus street, 5th District.
Market Street (now Opelousas Avenue), from Levee street to Vallette street, 5th District.
Magellan Street, from Madison street to Verret street, 5th District.
Monroe (now Teche) Street, from Market street to Lawrence street, 5th District.
Napoleon Avenue, from the River to Claiborne street, 6th District.
Nashville Avenue, from the River to Claiborne street, 6th District.
Natchez Street, from Tchoupitoulas street to Camp street, 1st District.
New Orleans Street, from Claiborne street to Marigny Avenue, 3d District.
Ninth Street, from the River to Camp street, 4th District.
Notre Dame Street, from the River to Magazine street, 1st District.
Nunn Street, rrom South Peters street to Religious street, 4th District.
Nelson (now Serantine) Street, from Broad street to Gentilly Road, 3d District.
New Orleans Street, from Marigny Avenue to Gentilly Road, 3d District.
Octavia Street, from the River to St. Charles street, 6th District.
Orange Street, from the River to Felicity Road, 1st District.
Orleans Street, from Royal street to Bayou St. John, 2d District.
Onzaga Street, from Prieur street to Gentilly Road, 3d District.
O'Reilly Street, from Broad street to Gentilly Road, 3d District.
Olivier Street, from the River to Market street, 5th District.
Palmyra Street, from Claiborne street to Bernadotte street, 1st District.
Pauline Street, from the River to Claiborne street, 3d District.
Peace (now Kerlerec) Street, from Chartres street to Bourbon street, 3d District.
Penniston Street, from Front street to Claiborne street, 6th District.
Perdido Street, from St. Charles street to Hagan Avenue, 1st District.
Perilliat Street, from Liberty street to Magnolia street, 1st District.
Peters Street, from Flood street to Barracks street, 3d District.
Peters Avenue, from the River to Bartholomew street, 6th District.
Philip Street, from the river to Claiborne street, 4th District.
Pine Street, from Levee street to Zimple street, 6th District.

Piety Street, from the River to Claiborne street, 3d District.
Pleasant Street, from the River to St. Charles street, 4th District.
Poeyfarre Street, from Tchoupitoulas street to Camp street, 1st District.
Poland Street, from the River to Claiborne street, 3d District.
Polymnia Street, from Coliseum street to Dryades street, 1st District.
Port Street, from the River to Claiborne street, 3d District.
Poydras Street, from the River to Broad street, 1st District.
Press Street, from the River to Claiborne street, 3d District.
Prytania Street, from Louisiana Avenue to Calhoun street, 6th District.
Pitt Street, from Louisiana Avenue to Audubon Park, 6th District.
Paris Avenue from St. Bernard Avenue to Gentilly Road, 3d District.
Perrier Street, from Nashville Avenue to Audubon Park, 6th District.
Pacific Avenue, from Patterson street to Lapeyrouse street, 5th District.
Race Street, from the River to Coliseum street, 1st District.
Rampart Street, from Calliope street to Poland street, 1st, 2d and 3d Districts.
Reynes Street, from the River to Villere street, 3d District.
Richard Street, from the River to Felicity Road, 1st District.
Robert Street, from the River to Claiborne street, 6th District.
Rocheblave Street, from Julia street to Toulouse street, 1st and 2d Districts.
Robin Street, from Levee to Camp street, 1st District.
Royal Street, from Canal street to Poland street, 2d and 3d Districts.
St. Andrew Street, from the River to Claiborne street, 4th District.
St. Ann Street, from the River to Broad street, 2d District.
St. Anthony Street, from Burgundy street to Marigny Avenue, 3d District.
St. Bernard Avenue, from St. Claude street to Broad street, 3d District.
St. Bernard (now Allen) Street, from Claiborne street to Marigny Avenue, 3d Dist.
St. Ferdinand Street, from the River to Claiborne street, 3d District.
St. James Street, from the River to Felicity Road, 1st District.
St. Joseph Street, from Delta street to Baronne street, 1st District.
St. Louis Street, from the River to Metairie Ridge, 2d District.
St. Peter Street, from the River to Bayou St. John, 2d District.
St. Philip Street, from the River to Bayou St. John, 2d District.
St. Mary Street, from the River to Carondelet street, 4th District.
St. Thomas Street, from Felicity Road to Toledano street, 4th District.
Sixth Street, from the River to Claiborne street, 4th District.
Seventh Street, from the River to Locust street, 4th District.
Second Street, from the River to Claiborne street, 4th District.
Short Street, from the River to Tenth Street, 7th District.
Soniat Street, from the River to Story street, 6th District.
Soraparu Street, from the River to Annunciation street, 4th District.
Spain Street, from the River to Prieur street, 3d District.
State Street, from the River to St. Charles street, 6th District.
St. Bernard (now Allen) Street, from Marigny Avenue to Gentilly Road, 3d Dist.
St. Anthony Street, from Marigny Avenue to Gentilly Road, 3d District.
St. Charles Avenue, from Julia street to Carrollton Avenue, 1st, 4th, 6th and 7th Districts.
St. Bernard Avenue, from Broad street to Gentilly Road, 3d District.
State Street, from St. Charles avenue to Victor street, 6th District.
Seguin Street, from Patters[illegible]rket street, 5th District.
Terpsichore street, from th[illegible]lia street, 1st District.

Thalia Street, from the River to Claiborne street, 1st District.
Theresa Street, from Tchoupitoulas street to St. Thomas street, 1st District.
Third Street, from the River to Claiborne street, 4th District.
Toledano Street, from the River to Claiborne street, 4th and 6th Districts.
Tonti Street, from Julia street to Toulouse street, 1st and 2d Districts.
Toulouse Street, from the River to Metairie Ridge, 2d District.
Triangle Street, from Front street to Peters street, 1st District.
Tricou Street, from the River to Claiborne street, 3d District.
Tchoupitoulas Street, from Canal street to Audubon Park, 1st, 4th and 6th Dists.
Thayer Street, from Patterson street to Lapeyrouse street, 5th District.
Union Street, from St. Charles street to Dryades street, 1st District.
Union (now Touro) Street, from Peace street to Gentilly Road, 3d District.
Upperline Street, from the River to Claiborne street, 6th District.
Upperline Street, from the River to Tenth street, 7th District.
Ursulines Street, from the River to Rendon street, 2d District.
Urania Street. from Coliseum street to Felicity Road, 1st District.
Valence Street, from the River to Claiborne street, 6th District.
Valmont Street, from the River to Leonie street, 6th District.
Valette Street, from the River to Lapeyrouse street, 5th District.
Verret Street, from the River to Lapeyrouse street, 5th District.
Walnut Street, from the River to Claiborne street, 6th District.
Warsaw Street, from St. Bernard avenue to Gentilly Road, 3d District.
Washington Avenue, from the River to Claiborne street, 4th District.
Washington (now St. Roche) Avenue, from Chartres street to Celestine street, 3d Disirict.
Webster Street, from Tchoupitoulas street to St. Charles avenue, 6th District.

A map on a scale of 600 feet to the inch has been plotted from the actual traverse lines as abave enumerated, on which map has also been placed, one foot contour lines. There has also been made a map of each of the proposed drainage sections, showing the location of the conduits and area of different zones tributary to same.

APPENDIX IV.

RAIN-FALL GAUGING.

For the purpose of obtaining accurate information regarding the precipitation, six "Frieze" self-registering rain gauges were purchased and placed at selected points throughout the city. These gauges automatically register the precise time and rate of precipitation, the amount being registered so as to read to hundredths of an inch. The total amounts recorded by the gauge were checked by actual measurement with a graduated stick. PlateVI shows the records of the rain storms which occurred on April 24th, July 4th, July 14th and August 13th, 1894. The locations selected for the gauges were such as to furnish the rate and intensity of precipitation in the different parts of the area now subject to drainage. One gauge was placed in Audubon Park near the river, one at the Dublin Avenue Draining Machine, one at the London Avenue Draining Machine, one at the corner of France and Levee streets, one at the City Hall, and one was located at West End, but was afterwards removed and placed at the corner of Magazine and Berlin Streets. These gauges were all installed, tested and in thorough operation by April 1st, 1894.

The necessity of having several gauges for the purpose of obtaining the average precipitation on a large area, is of paramount importance, as storms even of a general character, vary largely in precipitation, even within a small area and in New Orleans a large proportion of the storms are limited in area and do not simultaneously extend over the whole city. The records of precipitation at different points in any territory enable the direction and intensity of the storm to be observed and also indicate the sections which were visited by the greatest intensity during any one storm.

The records of rain-falls by these instruments have been carefully preserved and the volume of precipitation on the different areas calculated and tabulated.

Plate VII represents graphically the fall in inches and the duration of several storms of intense precipitation which have occurred in the City of New Orleans between April 1st and December 31st, 1894, the date of the several storms being marked on the plate.

Table I is a list of the storms which have occurred in the City of New Orleans between April 1st and December 31st, 1894, where the total precipitation did not exceed half an inch. This table also shows the maximum precipitation in five minutes, the maximum rate of precipitation per hour, the total precipitation in inches, the duration of storm, and the date.

Referring to this table it will be noted that the rate of precipitation is in many instances very great in comparison to the volume, as in the storm of April 25th when, with a total precipitation of 0.33 of an inch, the rate was 2.4 inches per hour; and five of these storms having a total precipitation of less than 0.5 of an inch had a rate of 1.8 inches per hour and upwards.

Table II is a list of the storms which have occurred in the City of New Orleans between April 1st and December 31st, 1894, having total precipitations

exceeding 0.5 of an inch and shows the date of maximum intensity in five minutes, maximum rate per hour, maximum precipitation per hour. total precipitation and duration of storms. Of the twenty-four storms referred to in this table, eleven had a rate of precipitation exceeding three inches per hour. The storm of August 13th had a rate of precipation of 6 inches per hour, and that of April 24th a rate of 5.4 inches per hour. These tables were compiled from gaugings made at the City Hall Station.

The greatest rate of precipitation on July 4th, as registered at the Park Station, was 7.2 inches per hour. It will also be noted that the greatest precipitation in one hour occurred on August 13th, when it was 2.75 inches, but the greatest intensity of this storm was at the rate of 6 inches per hour. On April 24th, with a maximum rate of 5.4 inches, the total precipitation in one hour was 1.9 inches, and on July 14th the maximum rate was 4.8 inches, and the total precipitation in one hour was 1.82 inches.

Table III is a list of storms of great intensity which have occurred in the States of Louisiana and Mississippi between the years 1872 and 1894.

Table IV is a list of storms which have occurred in the City of New Orleans from 1871 to 1894, in which the total precipitation exceeded 2 5 inches in twenty-four hours, as gauged by the New Orleans Station of the U. S. Signal Service and Department of Agriculture, Weather Bureau.

Table V is a list of storms which have occurred in the City of New Orleans from 1871 to 1894 in which the rate of precipitation exceeded one inch per hour, as gauged by the New Orleans Station of the U. S. Signal Service and Department of Agriculture, Weather Bureau.

APPENDIX V.

RUN-OFF GAUGING.

In order to obtain the volumes of water discharged at the different draining draining machines, flumes were established in the out-fall canals of the present drainage stations, for the purpose of obtaining uniform sections through which all the water lifted by each machine would pass. The dimensions of these flumes were such as to suit the existing conditions at the different stations:

At the Melpomene machine, the flumes had a width of						16 feet.
At the Bienville	"	"	"	"	"	23 feet.
At the Dublin	"	"	"	"	"	24 feet.
At the London	"	"	"	"	"	24 feet.

Across the top of each flume a suitable wharf was placed for the operator, provided with a strong substantial rail, which rail was 'graduated to facilitate the use of the meter. The gauging was performed with a "Price" current meter, and the operation was as follows:

The elevation of the water in the drainage and out-fall canals was observed and noted every 30 minutes, the difference in elevation being the height to which the water was lifted. Each time the gauging was made, a cross-section of the bottom of the channel was carefully taken and plotted. The meter was then placed in position six inches below the surface of the water and moved across the canal at a uniform rate. After which, the meter was lowered six inches more or one foot below the surface and moved in the same manner, and so on, the number of times necessary for the meter to be moved across the channel every 6 inches of its depths, and the calculation of velocity and discharge made in the usual manner, from the number of revolutions recorded by the register.

There was, also, located on each shaft, at each of the draining machines, a counter, which was constantly observed and recorded. The coal consumed was carefully weighed and a daily report made. The gauging of the discharge from the machines has been carried on very carefully from April 1st to December 1st, 1894, and all the varying conditions carefully noted, recorded and tabulated; and from the information thus obtained, a curve has been plotted from which can be obtained the discharge of the wheels, knowing the number of revolutions of the wheel and the elevation of the water in the inside and outside canals. These gaugings of the discharge of the machines were extremely arduous, as it was necessary for the work to be carried on continuously during and after rains, in order to obtain positive information of the amount of rainwater discharged, thus rendering it necessary for the men to remain at work day and night, oftentimes incessantly for periods of 36 hours.

The records of the gaugings of precipitation and discharge have been accurately compiled and tabulated, and graphical charts showing the amount of precipitation, in millions of cubic feet, falling on the area drained by each of the machines, have been prepared. These charts also show graphically the amount of water, in millions of cubic feet, discharged by each machine, the lift in feet and the coal consumed in tons.

Plate V is a chart showing graphically, from April 1st to December 31st, 1894, the volume of precipitation falling on the entire area of the city now subject to drainage, the volume discharged by all the draining machines, the duration of storms in hours, the lift in feet, the coal consumed in tons, and the total rainfalls in inches, as registered at the City Hall Station.

Table VI is a record of the gaugings from April 1st, to December 31st, 1894, of the total volume of precipitation and the total volume of discharge by the different draining machines for the entire area of the city now subject to drainage.

Table VII is a record of the gaugings from April 1st to December 31st, 1894, of the total volume of precipitation and discharge from the area now drained by the Bienville Draining Machine, which area is designated as the "First Drainage District" on Plate III.

It will be observed from this table that the proportion of storm water pumped in the aggregate after deducting the daily or normal flow varies greatly with the character of soil, as to its degree of saturation and imperviousness, and with the intensity of rainfall, as shown by the following table:

1894. Month.	Volume of Precipitation Cubic Feet.	Volume of Discharge Cubic Feet.	Volume of Normal or Daily Flow as per Table 8. Cubic Feet.	Volume of Precipitation Discharged Cubic Feet.	Per cent of. Precipitation Discharged.
April	36,891,085	51,765,512	32,507,520	19,257,992	52
May	16,069,284	39,786,732	33,591,104	6,195,628	39
June	32,926,278	48,174,960	32,507,520	15,667,440	47
July	51,279,921	76,547,856	33,591,104	42,956,752	83
August	64,828,533	82,202,112	33,591,104	48,611,008	75
September	10,870,394	34,643,325	32,507,520	2,135,805	20
October	2,756,985	37,133,615	33,591,104	.....	.....
November	8,822,352	36,199,496	32,507,520	3,691,976	42
December	9,863,653	39,033,593	33,591,104	5,442,489	55

The largest proportion of the precipitation ultimately discharged by the draining machines was during the months of July and August, when heavy rainfalls occurred nearly every day.

During the month of October, after deducting the normal flow, the discharge exceeded the total volume of precipitation due to the fact that this month was very dry and a famine of cistern water prevailed. To alleviate the situation in the district drained by the Bienville Machine an extensive use was made of the water from the water works to supply, through gutters, the sections not having mains and a most liberal use of hydrants where mains existed, so that the normal flow was very largely increased. For the months of November and December it was from similar causes, also increased, so that the results for October, November and December cannot be considered as furnishing proper proportions as only comparatively light rains occurred during these months, a consideration of the results can be properly omitted.

The results from the other six months can be assumed as giving a reasonable proportion, under varying conditions, of the precipitation ultimately discharged by the present system. It will be noted that

20 per cent. of 11 millions of precipitation was discharged in September.
39 " " 16 " " " " " " May,
47 " " 32 " " " " " " June,
52 " " 36 " " " " " " April.

The soil during these four months was moderately saturated.

75 per cent. of 64 millions of precipitation was discharged in August.
83 " " 51 " " " " " " July.

The soil during these two months was excessively saturated. During the two months of July and August it rained almost daily, but in July the daily rate of precipitation was more uniform than in August.

Table VIII is a record of the gaugings of the volume discharged by the several draining machines from the entire area of the city now subject to drainage, during a period of forty consecutive days, when no precipitation occurred. This Table also gives the volume of the average present normal discharge.

The area drained by the Dublin and Melpomene Stations (which stations act in conjunction in draining the area) has an aggregate of 7,709 acres. The present daily flow from this area, as determined by the foregoing table, equals 3.56 cubic feet per acre per hour.

The area drained by the Bienville draining machine (which is independent) has an aggregate of 2,170 acres. The daily flow, as ascertained from Table VIII would therefore amount to 20.8 cubic feet per acre per hour.

The area drained by the London Avenue Station has an aggregate of 3,478 acres. The daily flow from this area, as determined from Table VIII equals 5.8 cubic feet per acre per hour.

The ultimate daily flow to be discharged by the proposed system, will not be at a rate per acre, in excess of the daily flow now reaching the drainage stations. The sewerage system will be completed at an early date, and will receive a considerable portion of the water which now constitutes the daily flow, and an efficient system of drainage will deliver the run-off into the outfall canals quickly, not allowing the water to remain on the soil, as it now does. This will very materially reduce the amount of percolation and the seepage forming a large part of the present normal or dry-weather flow.

The conclusion reached concerning the volume of daily flow to be handled is, that from the commercial part of the city, it will not exceed twenty (20) cubic feet per acre per hour, and, from the suburban and vacant portions of the city, five (5) cubic feet per acre per hour. On this basis, the system is arranged for the removal of the daily flow, which aggregates, at the different Pumping Stations, the following quantities:

Pumping Sation No. 1 receives the drainage from 8,887 acres, aggregating 44,435 cubic feet to be delivered per hour.

Pumping Station No. 2 drains 5,384 acres (of which 1200 acres are allowed for at the rate of 20 cubic feet per acre per hour, aggregating 24,000 cubic feet, and 4184 acres at 5 cubic feet per acre per hour, aggregating 20,920 cubic feet per hour), making the total flow which will be required to be delivered from the section 44,920 cubic feet per hour.

The area drained at Pumping Station No. 3 contains 4,682 acres, and will furnish a normal flow of 23,410 cubic feet per hour.

Pumping Station No. 4 drains 2,153 acres, which will produce a normal flow of 10,765 cubic feet per hour.

Pumping Station No. 5 drains 2,878 acres, which will produce 14,390 cubic feet of normal flow per hour.

Algiers Station drains 948 acres, which will produce a normal flow of 4,740 cubic feet per hour.

APPENDIX VI.

TABLES.

TABLE I. Storms occurring in New Orleans between April 1st and December 31st, 1894, having a total Precipitation of LESS THAN 0.50 INCHES; showing date, maximum intensity in five minutes, maximum rate per hour and duration of storm, as automatically registered at City Hall Station.

DATE	Max. Pre. per 5 M. in in.	Max. Rate Per Hour in inches.	Total Pre. in inches.	Duration of Storm.	REMARKS
				H. M.	
April 25,.....	0.20	2.40	0.33	0 20	Short dash.
May 12,.....	0.15	1.80	0.32	0 15	" "
" 13,.....	0.02	0.24	0.13	2 20	Intermit drizzle.
" 16,.....	.....	0.60	0.03	0 03	Short dash.
" 17,.....	0.15	1.80	0.36	0 20	" "
" 23,.....	.....	.....	0.48	1 20	Register failed.
" 24,.....	0.04	0.48	0.11	0 45	Drizzle.
June 6,.....	0.07	0.84	0.06	0 05	Short dash.
" 8,.....	0.15	1.80	0.29	0 25	Two short dashes.
" 10,.....	0.10	1.20	0.35	8 00	Drizzle, except for 10 minutes, when .12" fell.
"	.....	.....	.....	.....	
" 19,.....	0.05	0.60	0.04	0 05	
" 20,.....	0.02	0.24	0.04	0 10	
" 24,.....	.....	0.60	0.02	0 02	Short dash.
July 5,.....	0.12	1.44	0.25	0 30	Several short dashes.
" 6,.....	0.10	1.20	0.23	0 20	Two " "
" 7,.....	0.07	0.84	0.11	0 10	Short dash.
" 8,.....	0.08	0.96	0.11	0 15	" "
" 9,.....	0.15	1.80	0.28	0 20	Two short dashes.
" 11,.....	0.03	0.36	0.05	0 10	Short dash.
" 12,.....	0.04	0.48	0.08	0 10	" "
" 13,.....	0.01	0.12	0.03	0 20	Drizzle.
" 16,.....	0.01	0.12	0.01	0 05	"
" 18,.....	0.02	0.24	0.16	2 00	"
" 21,.....	0.03	0.36	0.26	5 00	"
" 27,.....	0.02	0.24	0.10	0 50	"
" 28,.....	0.02	0.24	0.23	2 00	"
Aug. 2,.....	0.01	0.12	0.02	0 10	"
" 3,.....	0.02	0.24	0.06	0 25	"
" 8,.....	0.05	0.60	0.22	0 15	Two short dashes.
" 9,.....	0.10	1.20	0.50	0 30	" " "
" 10,.....	0.15	1.80	0.34	0 15	Short dash.
" 15,.....	0.06	0.72	0.13	0 22	Moderate shower.
" 17,.....	0.01	0.12	0.02	0 10	Drizzle.
" 21,.....	0.10	1.20	0.43	0 50	Severa dashes.
" 22,.....	0.06	0.72	0.10	0 10	Short dash.
" 23,.....	.....	0.60	0.03	0 03	
" 24,.....	0.07	0.84	0.31	0 30	Two short showers.
" 27,.....	.....	0.60	0.02	0 02	Short dash.
" 28,.....	0.08	0.96	0.43	0 30	Steady shower.
" 30,.....	.....	0.60	0.01	0 01	Short dash.
Sep. 7,.....	.....	1.40	0.07	0 03	" "
" 10,.....	0.12	0.72	0.12	0 05	" "
" 11,.....	0.10	0.60	0.22	0 20	Two short dashes.
" 12,.....	0.13	0.78	0.25	0 10	Short dash.
" 14,.....	0.01	0.12	0.02	0 10	" "
Nov. 13,.....	0.05	0.60	0.15	0 25	Short shower.
" 18,.....	0.10	1.20	0.23	0 40	" "
Dec. 6,.....	0.01	0.12	0.02	0 10	Drizzle.
" 9,.....	0.01	0.12	0.60	0 20	"
" 10,.....	0.05	0.60	0.12	0 30	Short shower.
" 11,.....	0.05	0.60	0.31	0 45	" "
" 16,.....	0.01	0.12	0.30	0 10	Drizzle.

TABLE II.—Storms occurring in New Orleans between April 1st, and December 31st, 1894, having a total Precipitation EXCEEDING 0.50 INCHES showing date, maximum intensity in five minutes, maxium rate per hour, duration of storm and maximum precipitation in inches in one hour, as automatically registered at City Hall Station.

DATE	Max. Pre. per 5 minute in inches.	Rate of Pre. per hour in inches.	Total Pre. in inches.	Duration Hr. Min.	Max. Pre. in inches for one hour.	REMARKS
April 4.....	0.26	3.12	0.59	1 35	0.60	Steady rain.
" 9.....	0.30	3.60	0.85	2 10	0.60	" "
" 24.....	0.45	5.40	2.40	2 00	1.90	Intermit. showers.
" 29.....	.....	.....	0.67	3 10	.....	Register failed.
May 14.....	0.15	1.80	0.60	2 00	0.37	Intermit't rain.
June 6.....	0.30	3.60	0.80	0 50	0.45	" showers.
" 9.....	0.25	3.00	1.12	1 00	0.70	" "
" 11.....	0.23	2.76	1.01	2 50	0.60	Steady rain
" 17.....	0.25	3.00	0.70	0 15	0.70	Heavy shower.
" 18.....	0.15	1.80	0.60	0 40	0.60	Steady "
July 2.....	0.30	3.60	0.55	0 25	0.55	Heavy "
" 3, 4.....	0.35	4.20	1.56	3 00	1.10	Several heavy showers.
" 14.....	0.40	4.80	1.82	0 55	1.82	Heavy shower.
" 16.....	0.30	3.60	1.70	0 55	1.70	Steady rain.
" 18.....	0.20	2.40	0.81	0 25	0.81	Heavy shower.
" 20.....	0.15	1.80	1.10	3 20	0.48	Intermit't rain.
" 27.....	0.15	1.80	1.34	3 15	0.50	" "
Aug. 13.....	0.50	6.00	2.96	6 30	2.75	Very heavy shower.
" 16	0.40	4.80	0.70	0 25	0.70	" " "
" 18.....	0.25	3.00	1.01	1 00	1.01	" " "
Oct. 28.....	0.15	1.80	0.88	1 25	0.35	Intermit't showers.
Nov. 2.....	0.10	1.20	0.68	3 00	0.33	Steady rain.
Dec. 26.....	0.15	1.80	0.89	3 00	0.70	Intermit't showers.
" 30.....	.....	.....	0.57	4 00	.....	Register failed.

TABLE III.—Showing date, duration, amount in inches and maximum intensity per hour of excessive precipitation in Louisiana and Mississippi, from 1872 to May, 1894, gauged by the United States Department of Agriculture—Weather Bureau.

Place.	State.	Date.	Amount in inches.	Duration. H. M.	Rate in in. Per Hour.
New Orleans	Louisiana	July 6, 1889	1.40	0 15	5.60
Monroe	"	Sep. 22, 1890	4.12	0 45	5.49
Vicksburg	Mississippi	Nov. 15, 1879	1.82	0 20	5.46
Logtown	"	Nov. 11, 1892	2.10	0 30	4.20
Louisville	"	Feb. 26, 1890	1.93	0 30	3.86
Marksville	Louisiana	Aug. 27, 1892	1.25	0 20	3.75
Emilie	"	Sep. 3, 1891	1.24	0 20	3.72
Houma	"	Sep. 25, 1889	3.60	1 00	3.60
Batesville	Mississippi	June 24, 1892	1.72	0 30	3.44
Houma	Louisiana	July 7, 1889	2.66	0 47	3.39
Logtown	Mississippi	Aug. 9, 1889	1.65	0 30	3.30
Emilie	Louisiana	Aug. 7, 1893	1.62	0 30	3.24
Houma	"	Apr. 25, 1894	1.35	0 25	3.24
Louisville	Mississippi	June 17, 1889	1.59	0 30	3.18
Luling	Louisiana	July 21, 1889	1.53	0 30	3.06
Meridian	Mississippi	July 8, 1891	1.52	0 30	3.04
Amite City	Louisiana	July 3, 1890	1.01	0 20	3.03
Homer	"	Dec. 5, 1890	3.00	1 00	3.00
Monroe	"	June 17, 1893	1.48	0 30	2.96
Melville	"	Apr. 14, 1894	1.50	0 31	2.90
Greenville	Mississippi	May 6, 1893	2.17	0 45	2.89
Duck Hill	"	May 14, 1893	1.20	0 25	2.88
Fayette	"	Aug. 2, 1893	1.43	0 30	2.86
Waynesboro	"	Aug. 26, 1892	1.40	0 30	2.80
Houma	Louisiana	July 2, 1889	3.49	1 15	2.79
Waynesboro	Mississippi	July 27, 1891	1.86	0 40	2.79
New Orleans	Louisiana	Sep. 25, 1889	1.39	0 30	2.78
Marksville	"	Aug. 9, 1892	1.15	0 25	2.76
Sugar Experimental Station	"	Apr. 24 1894	2.05	0 45	2.73
Rosebud	"	July 30, 1893	2.04	0 45	2.72
Coushatta	"	June 4, 1893	2.80	1 05	2.58
Pearlington	Mississippi	Aug. 15, 1889	2.55	1 00	2.55
Fayette	"	July 19, 1876	2.10	0 50	2.52
Sugar Experimental Station	Louisiana	Dec. 12, 1893	1.26	0 30	2.52
New Orleans	"	June 22, 1890	1.25	0 30	2.50
Jackson Barracks	"	July 15, 1890	1.25	0 30	2.50
Wallace	"	Aug. 23, 1893	1.25	0 30	2.50
Water Valley	Mississippi	May 27, 1893	3.03	1 13	2.49
New Orleans	Louisiana	July 3, 1881	2.48	1 00	2.48
Liberty Hill	"	July 8, 1892	2.23	0 55	2.43
Cameron	"	Sep. 25, 1893	1.21	0 30	2.42
Meridian	Mississippi	Sep. 5, 1889	1.60	0 40	2.40
Sugar Experimental Station	Louisiana	Sep. 14, 1891	1.20	0 30	2.40
New Orleans	"	Apr. 24, 1894	2.18	0 55	2.38
Winnfield	"	July 6, 1889	1.98	0 50	2.38
Lake Charles	"	Sep. 16, 1891	2.30	1 00	2.30
New Orleans	"	July 13, 1889	1.15	0 30	2.30
Farmerville	"	Mar. 23, 1893	1.13	0 30	2.26
Hattiesburg	Mississippi	July 2, 1893	1.13	0 30	2.26
Luling	Louisiana	Sep. 20-21, '91	9.32	4 10	2.24
Clinton	"	Aug. 3, 1893	3.34	1 30	2.23
Houma	"	June 19, 1890	1.04	0 28	2.23
Plaquemine	"	July 7, 1890	2.20	1 00	2.20
Liberty Hill	"	June 18, 1890	1.28	0 35	2.19
Fayette	Mississippi	Aug. 31, 1877	2.00	0 55	2.19
Meridian	"	June 8, 1891	1.78	0 50	2.14
Lafayette	Louisiana	June 14, 1892	1.07	0 30	2.14
New Orleans	"	Apr. 17, 1890	1.70	0 48	2.13
Baton Rouge	"	July 11, 1892	1.60	0 45	2.13
Shreveport	"	Sep. 24, 1872	2.05	0 58	2.12
Meridian	Mississippi	Mar. 8, 1891	2.10	1 00	2.10
Water Valley	"	May 14, 1893	1.40	0 40	2.10
Rienzi	"	July 3, 1891	1.04	0 30	2.08
Homer	Louisiana	Dec. 6, 1892	1.02	0 30	2.04
Meridian	Mississippi	June 9, 1891	1.52	0 45	2.03
Alexandria	Louisiana	Aug. 13, 1893	1.35	0 40	2.02
Wallace	"	July 18, 1893	2.01	1 00	2.01
Covington	"	Nov. 18, 1893	1.34	0 40	2.01
Edwards	Mississippi	Aug. 6, 1893	4.00	2 00	2.00
Shreveport	Louisiana	Dec. 11, 1884	2.00	1 00	2.00
New Orleans	"	June 6, 1888	2.00	1 00	2.00
New Orleans	"	Oct. 22, 1888	2.00	1 00	2.00
Houma	"	May 5, 1890	2.00	1 00	2.00
Vicksburg	Mississippi	June 12, 1891	2.00	1 00	2.00
Logtown	"	Nov. 2, 1892	2.00	1 00	2.00
Marksville	Louisiana	Oct. 20, 1892	1.50	0 45	2.00
New Orleans	"	July 7, 1890	1.00	0 30	2.00

By reference to Table II, showing storms occurring in New Orleans between April 1st and December 31st, 1894, of precipitation in excess of 0.5 inches, it will be noted that the storm of August 13th was at the rate of 6 inches per hour, or a storm of greater intensity than any enumerated in the above table.

The storm occurring in New Orleans on April 24th, had an intensity of 5.4 inches per hour.

The storm that visited New Orleans on July 4th, 1894 was registered by the Automatic Rain Gauge at the Audubon Park, or what is termed the "Park Station" registered a precipitation of 7.2 inches per hour.

TABLE IV.—Showing date and total precipitation of storms which have occurred in New Orleans, from 1871 to April, 1894, where the total precipitation was in excess of 2.5 inches in 24 hours, gauged by the New Orleans Station of the United States Department of Agriculture—Weather Bureau.

	Inches.
1871—October 2, 3	2.95
" 30	3.04
November 12, 13	2.80
1872—March 24, 25	4.50
November 7, 8	4.48
December 18	2.54
1873—May 5, 6	3.98
" 20	3.29
August 20, 21	4.08
November 4, 5	2.61
1874—April 16	3.84
July 3, 4	7.52
1875—February 19	3.71
March 11, 12	2.75
" 28, 30	3.81
April 20, 21	2.90
August 11, 12	2.77
September 25	5.28
December 4	3.82
1876—March 19	3.98
" 27	3.72
April 7	5.51
May 7, 8	4.09
November 2	2.61
December 31	2.59
1877—March 1	5.02
September 17, 18	7.22
October 24, 25	2.54
" 29, 30	3.52
1878—March 9	2.73
May 19	3.54
July 21	2.74
1879—April 16	2.82
August 13, 14	2.60
1880—March 8, 9	3.36
1881—January 3	2.82
July 3	3.25
November 6	2.99
December 13, 14	2.32
1882—	None
1883—January 18, 19	3.71
March 24	2.60
April 7, 8	9.22
June 8, 9	2.68
1884—April 4, 5	2.96
1885—January 4, 5	2.62
September 20	2.78
" 25, 26	3.23
December 12, 13	3.40
1886—January 14, 15	4.47
April 27, 28	2.67
1887—June 29	5.47
September 26, 27	2.88
October 18, 19	3.19
1888—February 20, 21	2.72
" 23, 24	4.21
June 6	2.86
" 21	4.44
August 14, 15	3.70
" 19, 20	8.90
" 24, 25	2.80
October 22, 23	4.13
1889—June 26	2.86
" 30	2.76
1890—June 22, 23	3.08
October 15, 16	2.63
1891—February 14, 15	2.60
December 14, 15	2.92
1892—January 10, 11	2.85
April 21, 22	7.49
August 15, 16	3.85
1893—February 11, 12	2.72
April 19, (8 hours 40 min.)	2.88
June 5, 6	3.02
October 1, 2	2.75
November 26, 27 (9 hours 30 min.)	3.35
1894—February 20, 21, (24 hours)	3.59

TABLE V.—Showing date and total precipitation of storms, which have occurred in New Orleans from 1871 to April, 1894, when the rate of precipitation exceeded 1 inch per hour, gauged by the New Orleans Station of the United States Department of Agriculture—Weather Bureau.

	Inches.
1871—June 30	1.10
July 31	1.16
1872—	None
1873—May 20	1.47
1874—	None
1875—	"
1876—	"
1877—	"
1878—	"
1879—April 16	1.00
August 13	1.00
1880—August 3	1.17
1881—June 6	1.30
July 3	2.48
1882—July 16	1.30
1883—	None
1884—July 4	1.00
October 21	1.00
1885—	None
1886—	"
1887—	"
1888—February 23	1.27
May 24	1.25
June 6	2.00
August 20, (estimated)	3.00
1888—August 24	2.56
October 22	2.00
1889—June —, —	1.19
" 30	1.50
July 6, (15 min.)	1.40
" 8	1.95
" 9	1.04
" 12	1.20
" 13, (30 min.)	1.15
September 25, (30 min.)	1.39
1890—April 17, (45 min.)	1.70
June 22, (30 min.)	1.25
July 7, (30 min.)	1.00
September 10	1.05
October 15	1.50
December 25	1.25
1891—	None
1892—April 21, (2 hours)	2.90
" 22	1.06
May 9	1.13
July 7	1.26
August 16	1.07
1893—April 19	1.40
November 26, (2 hours)	2.00
December 12, (45 min.)	1.00

TABLE VI.—Record of gaugings from April 1st to December 31st, 1894, of total volume of precipitation and total volume of discharge from the entire area of the city now subject to drainage, the area aggregating 13,357 acres.

APRIL	Volume of Precipitation Cubic Feet.	Volume of Discharge Cubic Feet.	JUNE	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1			1		1,407,511
2		4,550,173	2		4,672,014
3		2,768,739	3		
4		3,581,264	4		1,601,120
5	33,131,597	11,413,954	5		2,384,704
6		4,827,620	6	26,797,821	5,035,476
7		6,048,954	7		4,112,503
8			8		3,235,581
9	40,581,776	4,516,612	9	13,104,231	6,452,936
10		17,085,777	10	40,613,419	10,521,159
11		3,272,686	11	59,845,196	36,433,690
12		5,117,755	12		5,351,625
13		1,107,651	13		4,258,578
14		5,090,244	14		3,998,978
15			15		3,346,488
16		2,226,474	16		5,089,713
17		4,816,311	17	18,021,788	1,443,572
18		2,215,178	18	8,419,929	5,961,567
19		3,984,561	19	19,436,109	8,437,397
20		1,247,879	20	12,272,598	12,241,423
21		4,217,058	21	5,585,226	4,845,864
22			22		3,779,008
23		2,520,903	23	2,798,367	5,826,262
24	109,572,021	51,805,021	24	757,508	
25			25		3,653,736
26	13,392,899	8,491,852	26		3,578,887
27		4,244,115	27		1,708,817
28		6,592,796	28		2,198,600
29	13,049,487	7,113,106	29		1,019,030
30		7,254,587	30		4,803,412
Total	209,727,780	176,811,270	Total	207,952,192	157,401,551

MAY	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.	JULY	Volume of Precipitation, Cubic Feet.	Volume of Discharge, Cubic Feet.
1	5,316,897	5,812,851	1		
2		2,732,271	2	15,226,325	2,695,632
3		4,661,094	3	34,618,637	8,129,682
4		2,211,755	4	64,104,965	23,396,354
5		3,449,255	5	3,540,411	16,735,572
6			6	5,704,290	9,691,732
7		2,818,392	7	17,870,345	9,634,042
8		4,260,136	8	10,644,938	4,275,110
9		1,473,820	9	11,529,786	6,536,387
10		2,189,256	10		5,961,896
11		1,436,479	11		1,395,122
12	10,568,708	5,103,372	12	2,471,775	5,950,377
13	10,874,464		13	5,845,643	1,941,948
14	36,678,827	19,394,717	14	50,323,235	25,408,590
15		3,393,720	15	1,249,554	10,508,036
16	21,441,720	3,474,394	16	37,380,614	32,143,767
17	6,543,438	9,942,552	17	2,618,173	9,243,320
18		4,305,000	18	46,214,473	27,971,791
19		4,407,311	19		10,422,004
20			20	6,984,410	5,486,222
21		2,113,606	21	53,901,724	33,187,162
22		2,474,031	22	17,581,541	11,043,092
23		3,512,325	23		9,730,940
24	23,518,552	5,002,028	24		5,749,324
25		3,249,710	25		1,577,532
26		4,027,785	26	4,678,089	4,344,724
27			27	40,851,184	16,334,289
28		1,708,572	28	9,433,534	10,216,519
29		4,344,933	29		6,456,700
30		1,471,120	30		5,685,109
31		2,803,738	31	484,858	3,795,955
Total	114,942,606	111,924,313	Total	443,258,504	325,739,830

TABLE VI.—(Continued).—**Record of gaugings from April 1st to December 31st, 1894, of total volume of precipitation and total volume of discharge from the entire area of the city now subject to drainage, the area aggregating 13,357 acres.**

AUGUST	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.	OCTOBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1		3,606,698	1		1,884,105
2	2,648,737	2,817,843	2		
3	11,483,395	4,470,437	3		3,873,332
4	717,215	5,207,186	4		
5			5		5,930,220
6		2,619,090	6		3,056,130
7		4,465,306	7		
8	6,929,742	1,642,850	8		679,185
9	8,513,439	4,845,860	9		3,052,077
10	16,576,939	5,276,769	10		2,163,072
11		7,364,698	11		1,094,600
12			12		4,259,580
13	142,915,496	27,048,047	13		4,070,271
14	615,067	45,450,522	14		
15	23,401,593	24,630,954	15		
16	14,761,939	14,599,248	16		4,048,328
17	9,314,470	10,943,000	17		
18	43,553,140	28,591,249	18		2,432,391
19		13,759,946	19		4,143,148
20		7,917,928	20		4,189,568
21	37,179,440	9,533,867	21		
22	4,666,945	18,151,003	22		
23		11,024,223	23		4,684,149
24	21,522,633	8,781,061	24		
25		9,585,536	25		2,698,168
26		1,275,317	26		4,849,096
27	7,523,611	4,586,760	27		3,748,592
28	20,789,227	6,573,283	28	16,947,416	
29	1,434,431	11,335,871	29	14,904,743	11,329,925
30	3,082,160	6,154,953	30		1,743,300
31		4,108,810	31		2,534,892
Total,	377,629,619	306,368,315	Total,	31,852,159	76,464,129

SEPTEMBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.	NOVEMBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1	126,251	5,064,958	1		
2	12,353,470		2	32,493,472	11,667,468
3		5,248,687	3		3,215,166
4		2,882,736	4		
5		3,818,439	5		3,216,114
6		2,400,609	6		
7	9,073,475	3,108,738	7		1,719,620
8		3,997,802	8		1,373,583
9			9		4,625,940
10	11,223,669	3,230,544	10		4,126,578
11	6,638,398	3,074,902	11		
12	14,064,870	4,198,586	12		1,977,576
13	2,093,021	5,655,504	13	6,989,092	1,269,023
14	2,778,945	3,080,026	14		2,286,200
15		3,655,182	15		
16			16		6,784,002
17	6,695,934	2,969,217	17		3,227,622
18		4,282,684	18		
19		1,722,268	19	15,934,175	4,753,633
20		2,191,086	20		
21		1,677,176	21		2,269,160
22		4,185,852	22		6,325,134
23			23	1,064,678	2,155,790
24		2,536,596	24		2,930,522
25		3,732,457	25		
26		1,593,395	26		1,983,339
27		1,942,972	27		1,611,558
28		526,386	28		2,286,285
29		3,823,146	29		4,680,120
30			30		2,056,160
Total,	65,048,033	81,500,008	Total,	56,481,417	76,540,593

TABLE VI.—(Continued).—Record of gaugings from April 1st to December 31st, 1894, of total volume of precipitation and total volume of discharge from the entire area of the city now subject to drainage, the area aggregating 13,357 acres.

DECEMBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1		3,397,478
2		
3		1,075,590
4	1,533,348	4,157,032
5		4,399,616
6	484,858	2,060,154
7	279,836	
8		6,579 181
9	2,914,199	
10	3,957,643	2,296,262
11	18,741,544	3,134,486
12		7,004,954
13		3,535,920
14		
15		5,559,577
16	969,717	
17		1,726,272
18		3,418,751
19		
20		5,882,962
21		1,556,415
22		4,140,483
23		
24		3,237,318
25		
26		12,380,912
27		1,609,875
28		1,989,000
29		3,455,507
30	30,146,496	4,134,565
31		8,805,105
Total	59,027,641	95,537,415

TABLE VII.—Record of gaugings from April 1st to December 31st, 1894, of total volume of precipitation, and total volume of discharge from area drained by the Bienville Draining Machine; the area aggregating 2,170 acres.

APRIL.	Volume of Precipitation Cubic Feet.	Volume of Discharge Cubic Feet.	JUNE.	Volume of Precipitation Cubic Feet.	Volume of Discharge Cubic Feet.
1			1		875,665
2		1,385,909	2		843,160
3		1,048,179	3		
4		1,122,396	4		1,264,592
5	4,726,260	2,764,580	5		1,255,176
6		1,567,800	6	3,623,466	973,086
7		1,161,600	7		2,010,159
8			8		955,974
9		1,770,312	9	2,205,588	2,521,114
10	6,695,535	3,869,648	10	5,986,596	2,464,770
11		1,576,800	11	9,452,520	9,385,500
12		1,276,800	12		568,080
13		1,107,651	13		1,197,616
14		1,052,625	14		1,361,156
15			15		1,000,034
16		1,421,605	16		1,002,140
17		1,742,275	17	2,914,527	1,443,572
18		1,529,493	18	2,284,359	2,348,837
19		1,043,219	19	3,465,924	2,716,720
20		838,470	20	2,363,130	2,379,000
21		1,141,701	21	630,168	1,788,800
22			22		1,513,720
23		1,875,819	23		1,558,845
24	18,905,040	10,569,660	24		
25			25		1,491,498
26	2,625,700	3,220,700	26		825,020
27		1,602,650	27		1,224,034
28		1,602,900	28		1,087,560
29	3,938,550	3,707,964	29		1,019,030
30		1,764,756	30		1,100,102
Total	36,891,085	51,765,512	Total	32,926,278	48,174,960

MAY.	Volume of Precipitation Cubic Feet.	Volume of Discharge Cubic Feet.	JULY.	Volume of Precipitation Cubic Feet.	Volume of Discharge Cubic Feet.
1		1,625,481	1		
2		1,183,446	2	1,890,504	2,182,644
3		1,080,770	3	3,308,382	3,367,320
4		1,055,805	4	6,695,535	3,999,282
5		1,243,464	5	472,626	3,605,634
6			6	551,397	2,056,600
7		1,723,302	7	1,496,640	1,515,890
8		1,345,311	8	2,205,588	
9		1,070,260	9	1,575,420	2,625,600
10		1,132,404	10		1,613,105
11		1,073,424	11		1,395,122
12	1,969,275	1,055,808	12	315,084	1,004,805
13	1,654,191		13	945,252	1,341,360
14	6,144,138	6,328,037	14		5,207,892
15		981,618	15		1,414,400
16	1,181,565	1,068,914	16	4,962,573	8,341,210
17	1,417,878	2,760,070	17	236,313	2,365,720
18		1,520,264	18	5,277,657	4,736,160
19		1,104,026	19		1,643,390
20			20	630,168	1,435,378
21		1,320,120	21	7,877,100	6,057,912
22		1,109,911	22	3,938,850	2,571,075
23		1,034,583	23		2,812,026
24	3,702,237	2,135,078	24		1,512,195
25		1,049,824	25		1,577,532
26		1,010,792	26	787,710	
27			27	6,695,535	5,513,508
28		1,201,860	28	1,339,107	2,189,041
29		1,577,340	29		
30		981,708	30		3,016,116
31		1,004,112	31	78,771	1,446,939
Total	16,069,284	39,786,732	Total	51,279,921	76,547,856

TABLE VII.—(Continued.)—Record of gaugings from April 1st to December 31st, 1894, of total volume of precipitation, and total volume of discharge from area drained by the Bienville Draining Machine; the area aggregating 2,170 acres.

AUGUST	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1		1,335,996
2	157,542	1,302,480
3	2,993,298	1,166,536
4	157,542	1,500,794
5		
6		1,547,250
7		1,516,671
8	630,168	1,122,136
9	1,654,191	1,532,700
10	2,599,443	2,472,600
11		2,245,100
12		
13	24,812,865	5,043,271
14	236,313	9,168,896
15	4,174,863	7,788,116
16	2,678,214	3,101,838
17	1,417,878	2,781,224
18	6,380,451	6,336,316
19		3,514,500
20		1,894,732
21	6,537,993	1,215,500
22	551,397	6,754,266
23		2,586,216
24	3,781,008	2,836,790
25		2,182,700
26		
27	1,732,962	2,195,320
28	3,850,779	1,503,310
29	315,084	3,861,054
30	157,542	2,137,100
31		1,558,700
Total,	64,828,533	82,202,112

OCTOBER	Volume of Precipitation Cubic Feet.	Volume of Discharge. Cubic Feet.
1		1,884,105
2		
3		2,281,544
4		
5		1,959,600
6		1,387,530
7		
8		679,185
9		1,844,505
10		2,163,072
11		
12		
13		3,049,002
14		
15		
16		2,785,898
17		
18		2,432,391
19		
20		2,388,204
21		
22		
23		2,912,085
24		
25		2,698,168
26		
27		2,466,936
28	1,181,565	
29	1,575,420	3,476,850
30		1,743,300
31		981,240
Total,	2,756,985	37,133,615

SEPTEMBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1		1,460,430
2	945,252	
3		2,054,392
4		1,297,620
5		1,300,050
6		1,141,764
7	787,710	1,230,718
8		1,227,340
9		
10	2,756,985	2,243,646
11	1,260,336	1,171,198
12	2,441,901	2,080,453
13	315,084	1,938,924
14	315,084	1,515,105
15		1,287,018
16		
17	2,048,046	2,274,507
18		1,272,877
19		1,186,804
20		962,730
21		1,157,993
22		1,078,575
23		
24		1,554,888
25		1,184,625
26		1,025,786
27		1,021,282
28		
29		1,965,600
30		
Total,	10,870,398	34,643,325

NOVEMBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1		
2	5,592,741	3,786,210
3		2,162,646
4		
5		2,244,834
6		
7		1,719,620
8		1,373,583
9		
10		2,223,378
11		
12		1,977,576
13		
14		2,286,200
15		
16		2,191,374
17		1,388,358
18		
19	3,229,611	2,747,161
20		
21		2,269,160
22		
23		2,155,790
24		1,347,822
25		
26		1,983,339
27		
28		2,286,285
29		
30		2,056,160
Total,	8,822,352	36,199,496

TABLE VII.—(Continued.)—Record of gaugings from April 1st, to December 31st, 1894, of total volume of precipitation, and total volume of discharge from area drained by the Bienville Draining Machine; the area aggregating 2,170 acres.

DECEMBER	Volume of Precipitation. Cubic Feet.	Volume of Discharge. Cubic Feet.
1,.....		1,465,290
2,.....		
3,.....		1,075,590
4,.....	315,084	2,156,382
5,.....		
6,.....	78,771	2,060,154
7,.....		
8,.....		2,302,182
9,.....	883,759	
10,.....	708,939	2,296,262
11,.....	2,914,527	1,005,660
12,.....		1,772,928
13,.....		1,678,300
14,.....		
15,.....		2,033,350
16,.....	157,542	
17,.....		1,726,272
18,.....		1,675,485
19,.....		
20,.....		1,718,982
21,.....		1,556,415
22,.....		1,120,647
23,.....		
24,.....		1,990,044
25,.....		
26,.....		3,489,865
27,.....		1,609,875
28,.....		
29,.....		2,315,907
30,.....	4,805,031	1,926,405
31,.....		2,057,598
Total,.....	9,863,653	39,033,593

TABLE VIII.—Records of gaugings of volume of water discharged by the different draining machines, from September 28th to October 27th, or for forty consecutive days, during which no precipitation occurred.

DATE.	Dublin and Melpomene Stations, Cubic Feet.	Bienville Station, Cubic Feet.	London Station, Cubic Feet.
September 18	1,518,678	1,272,877	1,491,129
" 19	535,464	1,186,804	
" 20	1,228,356	962,730	
" 21	519,183	1,157,993	
" 22	1,303,575	1,078,575	1,803,702
" 23			
" 24	981,708	1,554,888	
" 25	1,005,480	1,184,625	1,542,352
" 26	567,609	1,025,786	
" 27	921,690	1,021,282	
" 28	526,386		
" 29		1,965,600	1,857,546
" 30			
October 1		1,884,105	
" 2			
" 3		2,281,544	1,591,788
" 4			
" 5	3,970,620	1,959,600	
" 6		1,387,530	1,668,600
" 7			
" 8		679,185	
" 9		1,844,505	1,207,572
" 10		2,163,072	
" 11			1,094,600
" 12	4,259,580		
" 13		3,049,002	1,021,269
" 14			
" 15			
" 16		2,785,898	1,262,430
" 17			
" 18		2,432,391	
" 19	4,143,148		
" 20		2,388,204	1,801,364
" 21			
" 22			
" 23		2,912,085	1,772,064
" 24			
" 25		2,698,168	
" 26	4,849,096		
" 27		2,466,936	1,281,656
Total for 40 days	26,330,573	43,343,385	19,396,072
Total per day	658,264	1,083,584	484,902

TABLE IX.—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
EUPHROSINE.			BROAD ..... Riverside.	77		B	.002	105	
				21		B	.001	29	
				17		C	.001	20	
				78		D	.001	30	
					193				184
	Franklin		EUPHROSINE Upperside	77		B	.002	105	
					77				105
			CLIO	37		B	.002	53	
					37				53
MELPOMENE.			BROAD ..... Riverside.	575		A	.002	700	
				696		B	.001	567	
				466		C	.001	310	
				161		D	.001	53	
					1898				1630
			CLAIBORNE .. Lakeside.	575		A	.002	700	
				696		B	.001	567	
				466		C	.001	310	
				50		D	.001	20	
					1787				1597
			CLAIBORNE .. Riverside.	195		A	.002	287	
				233		B	.001	233	
				24		C	.001	28	
					452				548
			CAMP ..... Lakeside.	195		A	.002	287	
				99		B	.001	114	
					294				401
			MELPOMENE Upperside.	380		A	.002	505	
				463		B	.001	410	
				442		C	.001	297	
				50		D	.001	20	
					1335				1232
	Claiborne ..		THIRD .. .. Lowerside.	380		A	.002	505	
				463		B	.001	410	
				366		C	.001	256	
				25		D	.001	10	
					1234				1181
			THIRD ..... Upperside.	71		C	.001	71	
				25		D	001	10	
					96				81
			CLAIBORNE .. Riverside.	380		A	.002	505	
				463		B	.001	410	
				295		C	.001	217	
	Third.....				1138				1132
			LIBERTY..... Lakeside.	380		A	.002	505	
				463		B	.001	410	
				265		C	.001	200	
					1108				1115
			THIRD ..... Upperside.	95		C	.001	91	
					95				91
			TOLEDANO.....	23		C	.001	28	
		LIBERTY			23				28
			THIRD .. .. Lowerside.	94		C	.001	90	
					94				90
			ST. ANDREW..	20		C	.001	25	
					20				25
			LIBERTY..... Riverside.	380		A	.002	505	
				463		B	.001	410	
				76		C	.001	75	
	Third.....				919				990
			CARONDELET Lakeside.	380		A	.002	505	
				463		B	.001	410	
				46		C	.001	48	
					889				963

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
			THIRD Upperside.	134 19	153	B C	.001 .001	149 23	172
			PLEASANT	36 5	41	B C	.001 .001	45 7	52
		CARONDELET	THIRD Lowerside.	143 27	170	B C	.001 .001	155 32	187
			ST. MARY	23 3	26	B C	.001 .001	30 5	35
			CARONDELET Riverside.	380 186	566	A B	.002 .001	505 193	698
	Third		CONSTANCE Lakeside.	380 146	526	A B	.002 .001	505 157	662
			THIRD Upperside.	109 72	181	A B	.002 .001	175 87	262
		CONSTANCE	TOLEDANO	15 15	30	A B	.002 .001	30 20	50
			THIRD Lowerside.	271 74	345	A B	.002 .001	380 90	470
			ST. MARY	143 12	155	A B	.002 .001	220 18	238
			BROAD Riverside.	368 227 412 199 129	1335	B B C C D	.003 .002 002 .001 .001	445 268 337 160 45	1255
NAPOLEON			CLAIBORNE Lakeside.	368 227 412 199 49	1255	B B C C D	.003 .002 .002 .001 .001	445 268 337 160 19	1229
			NAPOLEON Upperside.	52 17	69	C D	.001 .001	53 8	61
	Claiborne.		NAPOLEON Lowerside.	107 32	139	C D	.001 .001	100 13	113
			CLAIBORNE Riverside.	368 227 412 40	1047	B B C C	.003 .002 .002 .001	445 268 337 45	1095
NAPOLEON			LIBERTY Lakeside.	368 227 412	1007	B B C	.003 .002 .002	445 268 337	1050
			NAPOLEON Upperside.	75	75	C	.002	85	85
			UPPERLINE	27	27	C	.002	35	35
	S. Liberty.		NAPOLEON Lowerside.	147	147	C	.002	145	145
			DELACHAISE	30	30	C	.002	38	38

TABLE IX.—(Continued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
				268		B	.003	445	
			LIBERTY.....	227		B	.002	268	
			Riverside.	190		C	002	178	
NAPOLEON					785				891
				368		B	.003	445	
			PITT	221		B	.002	263	
			Lakeside.	142		C	.002	140	
					731				848
			NAPOLEON ...	116		C	.002	120	
			Upperside.		116				120
			ROBERT	23		C	.002	30	
	Pitt				23				30
			NAPOLEON ...	184		B	.002	225	
			Lowerside.		184				225
			DELACHAISE	36		B	.002	53	
					36				53
				368		B	.003	445	
			PITT	37		B	.002	53	
			Riverside.	26		C	.002	33	
NAPOLEON					431				531
				368		B	.003	445	
			CONSTANCE..	16		B	.002	23	
			Lakeside.	5		C	.002	7	
					389				475
				160		B	.003	217	
			NAPOLEON ...	16		B	.002	23	
			Upperside.	5		C	.002	7	
					181				247
				16		B	.002	23	
			VALMONT	5		C	.002	7	
	Constance				21				30
			NAPOLEON ...	208		B	.003	275	
			Lowerside.		208				275
			DELACHAISE	28		B	.003	46	
					28				46
				18		B	.003	33	
				60		B	.002	85	
				787		C	.002	562	
			CLAIBORNE..	25		C	.001	28	
			Riverside.	164		D	.002	62	
NASHVILLE					1054				770
				18		B	.003	33	
				60		B	.002	85	
				787		C	.002	562	
			ROBERTSON..	164		D	.002	62	
			Lakeside.		1029				742
				79		C	.002	87	
			NASHVILLE..	33		D	.002	17	
			Upperside.		112				104
				6		C	.002	7	
			PARK	33		D	.002	17	
	Robertson				39				24
			NASHVILLE..	164		C	.002	158	
			Lowerside.		164				158
			ROBERT.....	30		C	.002	38	
					30				38
				18		B	.003	33	
				60		B	.002	85	
			ROBERTSON..	544		C	.002	422	
			Riverside.	131		D	.002	50	
NASHVILLE					753				590
				18		B	.003	33	
				60		B	.002	85	
			PITT	490		C	.002	387	
			Lakeside.	131		D	.002	50	
					699				555

TABLE IX.—(Coniuued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT		Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
NASHVILLE	Pitt	NASHVILLE Upperside.	100		C	.002	156	
			75	235	D	.002	32	188
		PARK	18		C	.002	25	
			75	93	D	.002	32	57
		NASHVILLE Lowerside.	145	145	C	.002	144	144
		DUFOSSAT	25	25	C	.002	32	32
		PITT Riverside.	18		B	.003	23	
			60		B	.002	85	
			185		C	.002	175	
			56	319	D	.002	25	318
	Constance	CONSTANCE Lakeside.	18		B	.003	33	
			60		B	.002	85	
			152		C	.002	150	
			56	286	D	.002	25	293
		NASHVILLE Upperside.	30		B	.002	45	
			118		C	.002	122	
			56	204	D	.002	25	192
		PARK	12		C	.002	15	
			56	68	D	.002	25	40
		NASHVILLE Upperside.	18		B	.003	33	
			30		B	.002	45	
			34	82	C	.002	43	121
		PETERS AVE.	18		B	.003	33	
			12	30	C	.002	15	48
CLAIBORNE		MAIN CANAL. Riverside.	64		C	.001	65	
			16	80	D	.001	7	72
TOLEDANO		BROAD Riverside.	84	84	D	.001	31	31
		PRIEUR	24	24	D	.001	10	10

TABLE IX.—(Continued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
CLAIBORNE			BROAD Lakeside.	129		C	.001	114	
				149		D	.001	50	
					278				164
VENUS			BROAD Lakeside.	18		C	.003	27	
				314		C	.002	270	
				1100		C	.001	583	
				114		D	.003	50	
				304		D	.002	98	
				1849		D	.001	270	
					3699				1298
			HAGAN Riverside.	18		C	.003	27	
				314		C	.002	270	
				1100		C	.001	583	
				114		D	.003	50	
				304		D	.002	98	
				1803		D	.001	260	
					3653				1288
	Hagan Ave		VENUS	403		D	.001	100	
					403				100
			APRICOT	110		D	.001	39	
					110				39
			HAGAN Lakeside.	18		C	.003	27	
				314		C	.002	270	
				1100		C	.001	583	
				114		D	.003	50	
				304		D	.002	98	
				1400		D	.001	215	
					3250				1243
VENUS or Seventeenth.			DUBLIN Riverside.	18		C	.003	27	
				314		C	.002	270	
				1067		C	.001	570	
				114		D	.003	50	
				304		D	.002	98	
				1315		D	.001	206	
					3132				1221
	Dublin		SEVENTEENTH	18		C	.003	27	
				314		C	.002	270	
				954		C	.001	526	
				128		D	.002	50	
				389		D	.001	98	
					1803				971
			OLEANDER Lakeside.	18		C	.003	27	
				314		C	.002	270	
				880		C	.001	497	
				128		D	.002	50	
				389		D	.001	98	
					1729				942
		OLEANDER	DUBLIN	212		D	.001	65	
					212				65
			LIVE OAK	38		D	.001	16	
					38				16
			OLEANDER Riverside.	18		C	.003	27	
				314		C	.002	270	
				880		C	.001	497	
				128		D	.002	50	
				177		D	.001	57	
					1517				901
	Dublin		CLAIBORNE Lakeside.	18		C	.003	27	
				314		C	.002	270	
				762		C	.001	450	
				128		D	.002	50	
				177		D	.001	57	
					1399				854

TABLE IX.—(Continued.) The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
			DUBLIN Upperside.	194		C	.002	182	
				267		C	.001	202	
				103		D	.001	37	
					564				421
			LEONIDAS Lowerside.	194		C	.002	182	
				156		C	.001	133	
				103		D	.001	37	
		CLAIBORNE			453				352
			LEONIDAS Upperside	118		C	.001	107	
				103		D	.001	37	
					221				144
			LAUREL GROVE	26		D	.001	11	
				12		C	.001	15	
					38				26
			CLAIBORNE Riverside.	194		C	.002	182	
				38		C	.001	43	
					232				225
		LEONIDAS	JEANNETTE Lakeside.	194	194	C	.002	182	182
			LEONIDAS Lowerside.	134	134	C	.002	135	135
		JEANNETTE	LEONIDAS Upperside.	60	60	C	.002	70	70
			GEN'L OGDEN	19	19	C	.002	25	25
				18		C	.003	27	
				120		C	.002	124	
				512		C	.001	334	
Claiborne			DUBLIN Lowerside.	128		D	.002	50	
				57		D	.001	23	
					835				558
				18		C	.003	27	
				120		C	.002	124	
				400		C	.001	275	
			CLAIBORNE	128		D	.002	50	
				40		D	.001	16	
					706				492
Lowerline				18		C	.003	27	
				120		C	.002	124	
				360		C	.001	253	
			JEANNETTE Lakeside.	128		D	.002	50	
				40		D	.001	16	
					666				470
			LOWERLINE	155	155	C	.001	132	132
		JEANNETTE	SHORT	46	46	C	.001	50	50
				18		C	.003	27	
				120		C	.002	124	
				205		C	.001	163	
			JEANNETTE Riverside.	128		D	.002	50	
				40		D	.001	16	
					511				380
Lowerline				18		C	.003	27	
				120		C	.002	124	
				180		C	.001	154	
			OAK Lakeside.	128		D	.002	50	
				40		D	.001	16	
					495				371
			LOWERLINE	53		C	.002	64	
				41		D	.002	18	
					94				82
		OAK	PARK	12		C	.002	14	
				41		D	.002	18	
					53				32

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIRST SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
VENUS or Seventeenth	Lowerline		Oak Riverside.	18		C	.003	27	
				67		C	.002	75	
				189		C	.001	154	
				87		D	.002	37	
				40		D	.001	16	
					401				309
			Pearl Lakeside.	18		C	.003	27	
				33		C	.002	43	
				189		C	.001	154	
				87		D	.002	37	
				40		D	.001	16	
					367				277
		Pearl	Lowerline	33		C	.002	38	
				64		C	.001	65	
					97				103
			Burdette	33		C	.002	38	
					33				38
	Lowerline		Pearl Riverside.	18		C	.003	27	
				125		C	.001	112	
				87		D	.002	37	
				40		D	.001	16	
					270				192
		Wall	Lowerline	18		C	.003	27	
				63		C	.001	64	
				87		D	.002	37	
					168				128
			Park	18		C	.003	27	
				87		D	.002	37	
					105				64
			Dublin Lakeside.	113		C	.001	105	
				114		D	.003	50	
				176		D	.002	65	
				926		D	.001	190	
					1329				410
	Bordeaux		Pumping Station No. 6.	114		D	.003	50	
				803		D	.001	155	
					917				205
			Up. Center Canal Upperside.	60		D	.003	30	
				791		D	.001	153	
					851				183
			Up. Center Canal Lowerside.	60		D	.003	30	
				20		D	.001	8	
					80				38
		Up. Center Canal	Bordeaux Lakeside.	771		D	.001	150	
					771				150
			Adams	66		D	.001	25	
					66				25

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

SECOND SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft Per Sec.	Max. Flow Cu. Ft. Per Sec.
ST. LOUIS	Galvez		BROAD Riverside.	345		A	.003	513	
				216		A	.002	313	
				164		B	.002	200	
				340		B	.001	317	
				130		C	.001	115	
					1195				1458
			GALVEZ Lakeside.	345		A	.003	513	
				216		A	.002	313	
				164		B	.002	200	
				340		B	.001	317	
				102		C	.001	95	
					1167				1438
			ST. LOUIS	309		B	.001	294	
				102		C	.001	95	
					411				389
			TULANE Lowerside.	283		B	.001	275	
				65		C	.001	66	
					348				341
			TULANE Upperside.	75		B	.001	90	
				65		C	.001	66	
					140				156
			JULIA	7		B	.001	10	
				5		C	.001	7	
					12				17
		TULANE	GALVEZ	208		B	.001	213	
					208				213
			CLAIBORNE	168		B	.001	178	
					168				178
			TULANE Upperside.	137		B	.001	150	
					137				150
		CLAIBORNE	JULIA	15		B	.001	23	
					15				23
			TULANE Lowerside.	31		B	.001	40	
					31				40
ST. LOUIS			GALVEZ Riverside.	345		A	.003	513	
				216		A	.002	313	
				164		B	.002	203	
				31		B	.001	40	
					756				1069
	Claiborne		CLAIBORNE Lakeside.	345		A	.003	513	
				216		A	.002	313	
				164		B	.002	203	
					725				1029
			ST. LOUIS	32		B	.002	48	
					32				48
ST. LOUIS			CLAIBORNE Riverside.	345		A	.003	513	
				216		A	.002	313	
				122		B	.002	157	
					683				983
			BASIN Lakeside.	345		A	003	513	
				216		A	.002	313	
				89		B	.002	120	
					650				946
			CANAL Lowerside.	345		A	.003	513	
				156		A	.002	235	
				71		B	.002	100	
					572				848
	Basin		CANAL Upperside.	192		A	.003	310	
				118		A	.002	182	
				71		B	.002	100	
					381				592
			JULIA	192		A	.003	310	
				55		A	.002	97	
				8		B	.002	15	
					255				422
	Julia		CAMP Lakeside.	192		A	.003	310	
					192				310

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

SECOND SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone.	Natural Slope of Surface of Area Drained.	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft Per Sec.
Julia	Camp		Julia	46	46	A	.003	90	90
			Girod	13	13	A	.003	28	28
			Camp Riverside.	146	146	A	.003	243	243
			Constance	125	125	A	.003	215	215
	Constance	Howard		72	72	A	.003	133	133
Canal			Basin	153	191	A	.003	255	325
				38		A	.002	70	
			Camp and Chartres	153	153	A	.003	255	255
	Chartres		Canal Lowerside.	72	72	A	.003	135	135
			St. Louis	5	5	A	.003	15	15
	Camp		Canal Upperside.	81	81	A	.003	146	146
			Lafayette	13	13	A	.003	28	28

TABLE IX.—(Continued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

SECOND SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
TOULOUSE			Broad Lakeside.	185		C	.002	175	
				792		C	.001	460	
				120		D	.003	52	
				224		D	.002	78	
				2621		D	.001	366	
					3942				1131
			Hagan Riverside.	185		C	.002	175	
				768		C	.001	450	
				120		D	.003	52	
				224		D	.002	78	
				2621		D	.001	366	
					3918				1121
	Hagan		Toulouse	296	296	C	.001	217	217
			Perdido	24	24	C	.001	28	28
			Hagan Lakeside.	185		C	.002	175	
				472		C	.001	313	
				120		D	.003	52	
				224		D	.002	78	
				2621		D	.001	366	
TOULOUSE or ORLEANS					3622				984
			Carrollton Riverside.	76		C	.002	85	
				472		C	.001	313	
				120		D	.003	52	
				224		D	.002	78	
				2621		D	.001	366	
					3513				894
			Orleans	372		C	.001	260	
				47		D	.002	22	
					419				282
			Banks Lowerside.	223		C	.001	175	
	Carrollton			47		D	.002	22	
					270				197
			Banks Upperside.	94	94	C	.001	90	90
			Gravier	18	18	C	.001	22	22
			Carrollton	129		C	.001	114	
		Banks		47		D	.002	22	
					176				136
			St. Patrick	18		C	.001	22	
				47		D	.002	22	
					65				44
			Carrollton Lakeside.	76		C	.002	85	
				100		C	.001	94	
				120		D	.003	52	
				177		D	.002	65	
				2621		D	.001	366	
TOULOUSE or ORLEANS					3094				662
			Murat Riverside.	76		C	.002	85	
				18		C	.001	21	
				120		D	.003	52	
				177		D	.002	65	
				2621		D	.001	366	
					3012				589
			Orleans	18		C	.001	22	
				50		C	.002	69	
				32		D	.002	15	
					100				106
	Murat		Customh'se	18		C	.001	22	
				12		D	.002	7	
					30				29

TABLE IX.—(Continued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

SECOND SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres	Total Area Acres.	Class of Zone.	Natural Slope of Surface of Area Drained.	Maximum Run-off Cubic Ft Per Sec.	Max. Flow Cu. Ft. Per Sec.
TOULOUSE or ORLEANS			MURAT Lakeside.	17		C	.002	22	
				120		D	.003	52	
				145		D	.002	55	
				2621		D	.001	366	
					2903				495
			METAIRIE ROAD	120		D	.003	52	
				144		D	.002	55	
				2621		D	.001	366	
					2885				473
			PUMPING STATION No. 7 Riverside.	120		D	.003	52	
				104		D	.002	42	
				2536		D	.001	356	
					2760				450
			ORLEANS	104		D	.002	43	
				1287		D	.001	226	
					1391				269
	Taylor		SOLOMON Upperside.	54		D	.002	25	
				1166		D	.001	197	
					1220				222
			SOLOMON Lowerside.	54		D	.002	25	
				138		D	.001	47	
					192				72
			ESPLANADE.	38		D	.001	15	
					38				15
		SOLOMON	TAYLOR Lakeside.	1028		D	.001	181	
					1028				181
			LAKESHORE.	68		D	.001	26	
					68				26
			ORLEANS	120		D	.003	52	
				1249		D	.001	213	
					1369				265
			CONTI Lowerside.	60		D	.003	30	
	Taylor			1136		D	.001	193	
					1196				223
			CONTI Upperside.	60		D	.003	30	
				208		D	.001	64	
					268				94
			MILNE.	53		D	.001	21	
					53				21
		CONTI	TAYLOR Lakeside.	928		D	.001	169	
					928				169
			DOLOPHON	62		D	.001	24	
					62				24

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

THIRD SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zo n.	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cn. Ft. Per Sec.
ORLEANS			BROAD Riverside.	23		A	.003	50	
				25		B	.002	38	
				193		B	.001	200	
				102		C	.001	95	
					343				383
			CLAIBORNE	23		A	.003	50	
				25		B	.002	38	
				104		B	.001	118	
					152				206
		Claiborne	ESPLANADE	2		A	.003	5	
				2		B	.002	3	
				10		B	.001	14	
					14				22
St. BERNARD			BROAD Riverside.	196		A	.003	315	
				44		A	.002	80	
				40		B	.002	70	
				56		B	.001	70	
				292		C	.001	215	
				40		D	.001	17	
					677				767
			CLAIBORNE Lakeside.	196		A	.003	315	
				44		A	.002	80	
				49		B	.002	70	
				56		B	.001	70	
				108		C	.001	100	
					453				635
			ST. BERNARD Upperside.	10		B	.002	17	
				8		B	.001	13	
				35		C	.001	39	
					53				69
			ESPLANADE.	10		B	.002	17	
				2		B	.001	2	
				6		C	.001	6	
		Claiborne			18				25
			ST. BERNARD Lowerside.	23		B	.002	35	
				33		B	.001	43	
				65		C	.001	65	
					121				143
			FRENCHMEN	4		B	.002	6	
				5		B	.001	6	
				7		C	.001	7	
					16				19
St. BERNARD or St. ANTHONY			CLAIBORNE Riverside.	196		A	.003	315	
				44		A	.002	80	
				16		B	.002	25	
				15		B	.001	20	
				8		C	.001	10	
					279				450
			BURGUNDY	196		A	.003	315	
				44		A	.002	80	
					240				395
			ST. ANTHONY Upperside.	164		A	.003	270	
				19		A	.002	38	
					183				308
			ST. PETER	34		A	.003	70	
		Burgundy			34				70
			ST. ANTHONY Lowerside.	32		A	.003	65	
				25		A	.002	47	
					57				112
			FRENCHMEN	8		A	.003	20	
				4		A	.002	10	
					12				30

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

THIRD SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.		Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone.	Natural Slope of Surface of Area Drained.	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu Ft. Per Sec.
ORLEANS		BROAD Lakeside.	198	198	D	.001	62	62
LONDON		BROAD Lakeside.	412 2807	3219	D D	.002 .001	123 392	515
		MARIGNY Riverside.	334 2897	3141	D D	.002 .001	105 392	497
		LONDON	93 712	805	D D	.002 .001	38 144	182
	Marigny	JUMONVILLE Lowerside.	45 676	721	D D	.002 .001	20 140	160
	JUMONV'LE	MARIGNY	306	306	D	.001	82	82
		JUMONVILLE Upperside.	45 370	415	D D	.002 .001	20 95	115
	Marigny	SAVAGE Lowerside.	45 347	392	D D	.002 .001	20 90	110
		SAVAGE Upperside.	51	51	D	.001	20	20
	FAIR GROUNDS OR SAVAGE	MARIGNY	45 296	341	D D	.002 .001	20 80	100
LONDON		MARIGNY Lakeside.	241 2095	2336	D D	.002 .001	82 303	385
		MONROE Riverside.	156 1835	1991	D D	.002 .001	52 272	324
		LONDON Upperside.	590	590	D	.001	128	128
	Monroe	HAMBURGH. Lowerside.	518	518	D	.001	120	120
		HAMBURGH. Upperside	91	91	D	.001	34	34
	HAMBURGH	MONROE. Lakeside.	427	427	D	.001	105	105
		VIENNA	71	71	D	.001	27	27
	Monroe	LONDON Lowerside.	156 1245	1401	D D	.002 .001	60 205	265
		ST. ANTHONY Upperside.	156 1193	1349	D D	.002 .001	60 200	260
	ST. ANTHONY	MONROE. Lakes'de.	346	346	D	.001	90	90
		EDINBURGH	56	56	D	.001	21	21

TABLE IX.—(Coniuued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

THIRD SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.		Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone.	Natural Slope of Surface of Area Drained.	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
Monroe		St. Anthony Lowerside.	156		D	.002	22	
			847		D	.001	160	
				1003				182
		Arts Upperside.	47		D	.002	22	
			628		D	.001	135	
				675				157
		Arts Lowerside.	47		D	.002	22	
			95		D	.001	35	
				142				57
	Arts	Monroe Lakeside.	533		D	.001	123	
				533				123
		Edinburgh	93		D	.001	35	
				93				35

TABLE IX.—(Continued.)---The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FOURTH SECTION.—ON RIVER SIDE OF MAIN CANAL.

NAME OF CONDUIT.		Point of Delivery	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
ST. ANTHONY		Broad ..... Riverside.	77		C	0 01	75	
			61		D	.001	23	
				138				98
		Roman	30		C	.001	34	
				30				34
WASHINGTON		Broad ..... Riverside.	67		C	.001	67	
			90		D	.001	33	
				157				100
		Roman	31		C	.001	35	
				31				35
LAFAYETTE		Broad ..... Riverside.	105		A	.003	185	
			112		A	.002	175	
			12		B	.003	20	
			87		B	.002	114	
			125		B	.001	140	
			169		C	.001	140	
			159		D	.001	53	
				769				827
		Claiborne Lakeside.	105		A	.003	185	
			112		A	.002	175	
			12		B	.003	20	
			87		B	.002	114	
			125		B	.001	140	
			162		C	.001	135	
			45		D	.001	18	
				648				787
		Lafayette. Lowerside.	38		B	.001	50	
			77		C	.001	75	
			45		D	.001	17	
				160				142
	Claiborne	Independence.	10		C	.001	12	
			3		D	.001	2	
				13				14
		Lafayette. Upperside.	31		B	.001	40	
			56		C	.001	58	
				87				98
		Elysian Fields	7		C	.001	5	
			5		D	.001	7	
				12				12
LAFAYETTE		Claiborne Riverside.	105		A	.003	185	
			112		A	.002	175	
			12		B	.003	20	
			87		B	.002	114	
			56		B	.001	70	
			20		C	.001	32	
				401				596
		St. Claude.	105		A	.003	185	
			112		A	.002	175	
			12		B	.003	20	
			87		B	.002	114	
			36		B	.001	46	
			8		C	.001	12	
				360				552

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FOURTH SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.	Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
St. Claude	Lafayette. Lowerside.	64		A	.003	120	
		73		A	.002	122	
		12		B	.003	20	
		87		B	.002	116	
		8		C	.001	12	
			244				390
	Independence.	4		A	.003	12	
		12		B	.003	20	
		2		C	.001	3	
			18				35
	Lafayette. Upperside.	41		A	.003	82	
		39		A	.002	70	
		36		B	.001	42	
			116				194
	Elysian Fields	11		A	.003	25	
		4		B	.001	5	
			15				30

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FOURTH SECTION.—ON LAKE-SIDE OF MAIN CANAL.

NAME OF CONDUIT.			Point of Delivery	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
WASHINGTON			BROAD Lakeside.	90		D	.002	38	
				422	512	D	.001	103	141
			PLEASURE	90		D	.002	38	
				356	446	D	.001	92	130
	Pleasure		WASHINGTON Lowerside.	50		D	.002	23	
				268	318	D	.001	75	98
			WASHINGTON Upperside.	40		D	.002	18	
				88	128	D	.001	33	51
MARIGNY			BROAD Lakeside.	84		D	.002	35	
				170	254	D	.001	55	90

TABLE IX.—(Continued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

FIFTH SECTION.—ON RIVER-SIDE OF MAIN CANAL.

NAME OF CONDUIT.		Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone	Natural Slope of Surface of Area Drained	Maximu Run-Off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
JOURDAN		BROAD Riverside.	31		A	.003	64	
			84		B	.003	125	
			375		C	.002	314	
			146		C	.001	125	
			433		D	.001	105	
				1069				733
		CLAIBORNE Lakeside.	31		A	.003	64	
			84		B	.003	125	
			375		C	.002	314	
			146		C	.001	125	
			251		D	.001	72	
				887				700
		JOURDAN Upperside.	119		C	.001	100	
			47		D	.001	19	
				166				119
	Claiborne	INDEPENDENCE	10		C	.001	12	
			3		D	.001	2	
				13				14
		JOURDAN Lowerside.	150		D	.001	50	
				150				50
		ADAMS	14		D	.001	6	
				14				6
JOURDAN		CLAIBORNE Riverside.	31		A	.003	64	
			84		B	.003	125	
			375		C	.002	314	
			27		C	.001	32	
			54		D	.001	22	
				571				557
		ST. CLAUDE	31		A	.003	64	
			84		B	.003	125	
			375		C	.002	314	
			2		C	.001	2	
			30		D	.001	13	
				522				518
	St. Claude	JOURDAN Upperside.	31		A	.003	64	
			84		B	.003	125	
			124		C	.002	127	
			2		C	.001	2	
				241				318
		INDEPENDENCE	4		A	.003	12	
			12		B	.003	20	
			2		C	.001	2	
				18				34
		JOURDAN Lowerside.	251		C	.002	224	
			30		D	.001	13	
				281				237
		ADAMS	22		C	.002	28	
			3		D	.001	2	
				25				30
LOUISA		BROAD Riverside.	182		D	.001	58	
				182				58
		ROMAN	42		D	.001	17	
				42				17
FRANCE		BROAD Riverside.	182		D	.001	58	
				182				58
		ROMAN	42		D	.001	17	
				42				17
FLORIDA		JOURDAN Riverside.	879		D	.001	164	
			282		C	.002	245	
				1161				409

TABLE IX.—(Continued.)—**The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.**

Volumes given in table are calculated from run-off curves shown on Plate VIII.

ALGIERS SECTION

NAME OF CONDUIT.	Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone.	Natural Slope of Surface of Area Drained.	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
	PUMPING STATION Riverside	56		B	.003	86	
		70		B	.002	96	
		84		C	.003	102	
		204		C	.002	190	
		33		C	.001	36	
		219		D	.002	83	
		282		D	.001	78	
			948				671
	LAWRENCE Riverside.	56		B	.003	86	
		70		B	.002	96	
		84		C	.003	102	
		204		C	.002	190	
		33		C	.001	36	
		219		D	.002	83	
		166		D	.001	55	
			832				648
CANAL AVE.	LAPEYROUSE Swampside.	56		B	.003	86	
		70		B	.002	96	
		84		C	.003	102	
		204		C	.002	190	
		33		C	.001	36	
		219		D	.002	83	
		130		D	.001	45	
			796				638
	LAPEYROUSE Riverside.	29		B	.003	48	
		107		C	.002	113	
		33		C	.001	36	
		145		D	.002	55	
		14		D	.001	7	
			328				259
	DECATUR Swampside.	29		B	.003	48	
		107		C	.002	113	
		33		C	.001	36	
		130		D	.002	50	
		14		D	.001	7	
			313				254
	CANAL	18		C	.001	23	
		70		D	.002	30	
		14		D	.001	7	
			102				60
Decatur	U. S. RESERVATION	4		C	.001	5	
		14		D	.001	7	
			18				12
	DECATUR Riverside.	29		B	.003	48	
		107		C	.002	113	
		15		C	.001	18	
		60		D	.002	27	
			211				206
CANAL AVE.	NEWTON Swampside.	29		B	.003	48	
		107		C	.002	113	
		15		C	.001	18	
		56		D	.002	25	
			207				204
Newton	CANAL	9		C	.002	13	
		39		D	.002	18	
			48				31
	NEWTON Riverside.	29		B	.003	48	
		98		C	.002	105	
		15		C	.001	18	
		17		D	.002	10	
			159				181
CANAL AVE.	ELIZA	29		B	.003	48	
		98		C	.002	105	
			127				153

TABLE IX.—(Continued.)—The Maximum volume of run-off from areas of different zones and flow in cubic feet per second, reaching the various conduits; also, area, class and slope of different zones tributary to conduits.

Volumes given in table are calculated from run-off curves shown on Plate VIII.

ALGIERS SECTION.

NAME OF CONDUIT.		Point of Delivery.	Area of Zone Trib. to Conduit Acres.	Total Area Acres.	Class of Zone.	Natural Slope of Surface of Area Drained.	Maximum Run-off Cubic Ft. Per Sec.	Max. Flow Cu. Ft. Per Sec.
Eliza		Canal Lowerside.	9		B	.003	12	
			59		C	.002	70	
				68				82
		U. S. Reservation	12		C	.002	15	
				12				15
		Canal Upperside.	20		B	.003	35	
			39		C	.002	48	
				59				83
		Verret	8		B	.003	18	
			15		C	.002	20	
				23				38
Lapeyrouse		Canal Upperside.	27		B	.003	43	
			70		B	.002	96	
			84		C	.003	102	
			97		C	.002	104	
			74		D	.002	32	
			116		D	.001	40	
				468				417
		Vallette Lowerside.	27		B	.003	43	
			70		B	.002	96	
			84		C	.003	102	
			97		C	.002	104	
			74		D	.002	32	
			56		D	.001	21	
				408				398
	Hancock	Lapeyrouse Swampside.	32		C	.002	37	
			56		D	.001	21	
				88				58
		Columbus	9		D	.001	4	
				9				4
Vallette		Lapeyrouse Riverside.	27		B	.003	43	
			70		B	.002	96	
			84		C	.003	102	
			65		C	.002	75	
			74		D	.002	32	
				320				348
		Newton Swampside	27		B	.003	43	
			70		B	.002	96	
			53		C	.003	66	
			65		C	.002	75	
			58		D	.002	27	
				273				307
	Newton	Vallette	9		C	.002	13	
			35		D	.002	17	
				44				30
Vallette		Newton Riverside.	27		B	.003	43	
			70		B	.002	96	
			53		C	.003	66	
			56		C	.002	65	
			23		D	.002	10	
				229				280
		Eliza	27		B	.003	43	
			70		B	.002	96	
			7		C	.003	10	
			56		C	.002	65	
				160				214
		Vallette Lowerside.	22		B	.003	30	
			33		C	.002	38	
				55				68
		Pacific	7		B	.003	12	
			12		C	.002	15	
				19				27
	Eliza	Vallette Upperside	5		B	.003	8	
			70		B	.002	96	
			7		C	.003	10	
			23		C	.002	27	
				105				141
		Powder	5		B	.003	8	
			7		C	.003	10	
				12				18
Lawrence		Canal	116		D	.001	40	
				116				93

TABLE X.- Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

FIRST SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot	Length in Feet.
EUPHROSINE	BROAD Riverside.	16.00	184		
	FRANKLIN	21.36	105	.0008	6700
FRANKLIN	EUPHROSINE	21.36	105		
	ERATO	22.08	53	.0008	900
MELPOMENE	BROAD Riverside.	16.96	1630		
	CLAIBORNE Lakeside.	18.48	1597	.0004	3800
CLAIBORNE	MELPOMENE Upperside.	18.48	1232		
	THIRD Lowerside.	19.16	1181	.0004	1700
THIRD	CLAIBORNE Riverside.	19.16	1132		
	SOUTH LIBERTY Lakeside.	20.66	1115	.0006	2500
	SOUTH LIBERTY Riverside.		990		
	CARONDELET Lakeside	21.92	963	.0006	2100
	CARONDELET Riverside.		898		
	CONSTANCE Lakeside.	25.28	662	.0012	2800
SOUTH LIBERTY	THIRD Upperside.	20.66	91		
	TOLEDANO	21.68	28	.0006	1700
	THIRD Lowerside,	20.66	90		
	FELICITY	22.04	25	.0006	2300
CARONDELET	THIRD Lowerside.	21.92	187		
	FELICITY	24.52	35	.001	2600
	THIRD Upperside.	21.92	172		
	TOLEDANO	24.02	52	.001	2100
CONSTANCE	THIRD Upperside.	25.28	262		
	TOLEDANO	27.93	50	.001	2650
	THIRD Lowerside.	25.28	470		
	ST. MARY	28.08	238	.001	2800

TABLE X.—(Continued.)—**Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.**

FIRST SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot.	Length in Feet.
NAPOLEON AVENUE	BROAD Riverside.	17.72	1255		
	CLAIBORFE Lakeside. CLAIBORNE Riverside.	19.00	1220 1095	.0004	3200
	SOUTH LIBERTY. Lakeside. SOUTH LIBERTY Riverside.	20.00	1050 891	.0004	2500
	PITT Lakeside. PITT Riverside.	21.12	848 531	.0004	2800
	CONSTANCE Lakeside.	24.64	475	.0016	2200
CLAIBORNE	NAPOLEON Upperside.	19.00	61		
	UPPERLINE	19.44		.0004	1100
	NAPOLEON Lowerside.	19.00	113		
	LOUISIANA AV.	19.76		.0004	1900
SOUTH LIBERTY	NAPOLEON Upperside.	20.00	85		
	UPPERLINE	20.56	35	.0004	1400
	NALOLEON Lowerside.	20.00	145		
	DELACHAISE	20.90	38	.0004	2250
PITT	NAPOLEON Upperside.	21.12	120		
	ROBERT	23.27	30	.001	21.50
	NAPOLEON Lowerside.	21.12	225		
	DELACHAISE	24.27	53	.001	3250
CONSTANCE	NAPOLEON Lowerside.	24.64	275		
	DELACHAISE	28.44	46	.001	3800
	NAPOLEON Upperside.	24.64	249		
	VALMONT	28.29	32	.001	3650
NASHVILLE AVE.	CLAIBORNE Riverside	19.00	770		
	S. ROBERTSON Lakeside. S. ROBERESON Riverside,	19.90	742 590	.0004	2250
	PITT Lakeside. PITT Riverside.	21.40	555 318	.0004	3750
	CONSTANCE Lakeside.	26.20	293	.002	2400

TABLE X. (Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits

FIRST SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot.	Length in Feet.
SOUTH ROBERTSON	NASHVILLE Upperside.	19.90	104		
	PARK	21.90	24	.0003	1550
	NASHVILLE Lowerside.	19.90	158		
	ROBERT	20.64	38	.0004	1850
PITT	NASHVILLE Lowerside.	21.40	144		
	DUFOSSAT	23.75	32	.001	2350
	NASHVILLE Upperside.	21.40	188		
	PARK		57		2100
CONSTANCE	NASHVILLE Upperside	26.20	192		
	PARK	28.80	40	.001	2600
	NASHVILLE Lowerside.	26.20	121		
	PETERS AVE	28.20	48	.0016	1250
CLAIBORNE	NASHVILLE Lowerside.	19.00	72		
	UPPERLINE	19.72		.0004	1800
TOLEDANO	BROAD Riverside,	17.32	31		
	PRIEUR	18.32	10	.0004	2500
CLAIBORNE	NASHFILLE Lakeside.	19.00	164		
	LOWERLINE Lowerside.	20.56		.0004	3900
VENUS	P. S. No. 1 Lakeside.	20.00			
	P. S. No. 6 Riverside.	13.92		.0004	15,200
LOWERLINE	CLAIBORNE Riverside.	20.56	492		
	JEANNETTE Lakeside	21.84	470	.0004	3200
	JEANNETTE Riverside.		380		
	OAK Lakeside.	22.28	371	.0004	1100
	OAK Riversida.		309		
	PEARL Lakeside.	24.28	277	.0008	2500
	PEARL Riverside.		192		
	WALL	25.88	128	.0008	2000

TABLE X.—(Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

SECOND SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot.	Length in Feet.
ST. LOUIS	BROAD, Riverside.	17.00	1458		
	GALVEZ, Lakeside.	17.84	1438	.0004	2100
	GALVEZ, Riverside.		1069		
	CLAIBORNE, Lakeside.	18.92	1029	.0006	1800
	CLAIBORNE, Riverside.		983		
	BASIN	19.94	946	.0006	1700
GALVEZ	ST. LOUIS, Upperside.	17.84	389		
	TULANE AVE. Lowerside.	18.92	341	.0004	2700
	TULANE AVE. Upperside.		156		
	JULIA	19.84	17	.0004	2300
TULANE AVENUE	GALVEZ, Riverside.	18.92	213		
	CLAIBORNE, Lakeside.	19.64	178	.0004	1800
CLAIBORNE	TULANE, Upperside.	19.64	150		
	JULIA	20.64	23	.0004	2500
	TULANE, Lowerside.	19.64	40		
	CANAL	20.12		.0006	800
CLAIBORNE	ST. LOUIS, Upperside.	18.92	48		
	CANAL	19.82		.0006	1500
BASIN	ST. LOUIS	19.94	946		
	CANAL, Lowerside.	20.84	848	.0006	1500
	CANAL, Upperside.		592		
	JULIA	22.88	422	.0006	3400
CANAL	BASIN, Riverside.	20.84	325		
	CAMP, Lakeside.	23.99	255	.0015	2100

TABLE X.—(Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

SECOND SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot	Length in Feet.
CAMP	CANAL, Upperside.	23.99	146		
	LAFAYETTE	27.39	28	.002	1700
CHARTRES	CANAL, Lowerside.	23.99	135		
	ST. LOUIS	28.04	15	.0027	1500
JULIA	BASIN	22.88	422		
	CAMP, Lakeside. / CAMP, Riverside.	24.86	310 / 243	.0009	2200
	CONSTANCE	26.46	215	.002	800
CAMP	JULIA, Lowerside.	24.86	90		
	LAFAYETTE	27.38	28	.0028	900
CONSTANCE	JULIA, Upperside.	26.46	215		
	HOWARD	28.46	133	.002	1000
ORLEANS and TOULOUSE	P. S. No. 2, Lakeside.	19.00			
	P. S. No. 7, Riverside.	14.08		.0004	12300

TABLE X.—(Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

THIRD SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second	Slope per Foot.	Length in Feet.
ST. BERNARD	BROAD Riverside	17.40	767		
	CLAIBORNE Lakeside.	19.50	635	.0005	4200
	CLAIBORNE Riverside.		450		
	BURGUNDY	21.98	395	.0008	3100
CLAIBORNE	ST. BERNARD Upperside.	19.50	69		
	ESPLANADE AVE.	22.50	25	.002	1500
	ST. BERNARD Lowerside.	19.50	143		
	ELYSIAN FIELDS	22.20	19	.001	1500
BURGUNDY	ST. ANTHONY Lowerside.	21.98	112		
	ELYSIAN FIELDS	24.58	30	.002	1300
	ST. ANTHONY Upperside.	21.98	308		
	ST. PETER	24.98	70	.001	3000
ORLEANS	BROAD Riverside.	19.42	383		
	CLAIBORNE	21.24	206	.0004	3800
CLAIBORNE	ORLEANS	21.24	206		
	ESPLANADE Upperside	22.62	22	.0006	2300
LONDON AVE.	P. S. No. 3 Lakeside.	20.00			
	P. S. No. 8 Riverside.	16.40		.0004	9000

TABLE X.—(Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

FOURTH SECTION.

NAME OF CANALS.	Elevation of Flood Line at,		Volume in Cubic Feet per Second.	Slope per Foot.	Length in Feet.
LAFAYETTE	MAIN CANAL ..... Riverside.	16.50	827		
	CLAIBORNE ..... Lakeside.	18.70	787	.0005	4400
	CLAIBORNE ..... Riverside.		596		
	ST. CLAUDE ..... Lakeside.	19.78	552	.0006	1800
CLAIBORNE	LAFAYETTE ..... Upperside.	18.70	98		
	ELYSIAN FIELDS ..	22.75	14	.0015	2700
	LAFAYETTE ..... Lowerside.	18.70	142		
	INDEPENDENCE....	21.10	14	.0006	4000
ST. CLAUDE	LAFAYETTE ..... Upperside	19.78	194		
	ELYSIAN FIELDS ..	23.98	30	.002	2100
	LAFAYETTE ..... Lowerside.	19.78	390		
	INDEPENDENCE....	22.98	35	.0008	4000
ST. ANTHONY	MAIN CANAL ..... Riverside.	18.88	98		
	ROMAN	20.86	34	.0006	3300
WASHINGTON	MAIN CANAL ..... Riverside.	17.72	100		
	ROMAN	21.02	35	.001	3300

TABLE X.—(Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

FIFTH SECTION.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot.	Length in Feet.
LOUISA	MAIN CANAL ..... Riverside.	19.00	58		
	ROMAN	20.44	17	.0004	3600
FRANCE	MAIN CANAL ..... Riverside.	17.84	58		
	ROMAN	20.00	17	.0006	3600
JOURDAN	MAIN CANAL ..... Riverside.	16.68	733		
	CLAIBORNE ..... Lakeside.	18.93	700	.0005	4500
	CLAIBORNE ..... Riverside.		557		
	ST. CLAUDE ..... Lakeside.	20.01	518	.0006	1800
CLAIBORNE	JOURDAN..... Upperside.	18.93	119		
	INDEPENDENCE....	21.03	14	.0005	4200
	JOURDAN..... Lowerside.	18.93	50		
	ADAMS	20.93	6	.0005	4000
ST. CLAUDE	JOURDAN..... Upperside.	20.01	318		
	INDEPENDENCE....	23.37	34	.0008	4200
	JOURDAN..... Lowerside.	20.01	237		
	ADAMS	23.21	30	.0008	4000
FLORIDA AVENUE	JOURDAN..... Lowerside.	16.68	400		
	LOWER PROTECTION	19.88		.0004	8000
LOWER PROTECTION	FLORIDA AVE	19.88			
	ST. CLAUDE	22.32		.0004	6100

TABLE X.—(Continued.)—Elevation of Flood Line and volume in cubic feet per second to be discharged at given points, also slope of Flood Line and lengths of conduits.

ALGIERS.

NAME OF CANALS.	Elevation of Flood Line at		Volume in Cubic Feet per Second.	Slope per Foot.	Length in Feet.
CANAL AVENUE	PUMPING STATION Riverside.	18.00	671		
	LAPEYROUSE Swampside.	19.56	638	.0012	1300
	LAPEYROUSE Riverside.		259		
	NEWTON Swampside.	21.76	204	.002	1100
	NEWTON Riverside.		181		
	ELIZA Swampside.	25.76	153	.002	2000
ELIZA	CANAL Lowerside.	25.76	82		
	U. S. RESERVATION	29.36	15	.002	1800
	CANAL Upperside.	25.76	83		
	VERRET	28.06	38	.002	1150
LAPEYROUSE	CANAL Upperside.	19.56	417		
	VALLETTE Lowerside.	22.80	398	.0012	2700
VALLETTE	LAPEYROUSE Riverside.	22.80	348		
	NEWTON Swampside.	24.12	307	.0012	1100
	NEWTON Riverside.		280		
	ELIZA Swampside.	26.52	214	.0012	2000
ELIZA	VALLETTE Upperside.	26.52	141		
	POWDER	29.92	18	.002	1700
	VALLETTE Lowerside.	26.52	68		
	PACIFIC	28.32	27	.002	900

[redacted]

[redacted]

CHART OF GAUGES

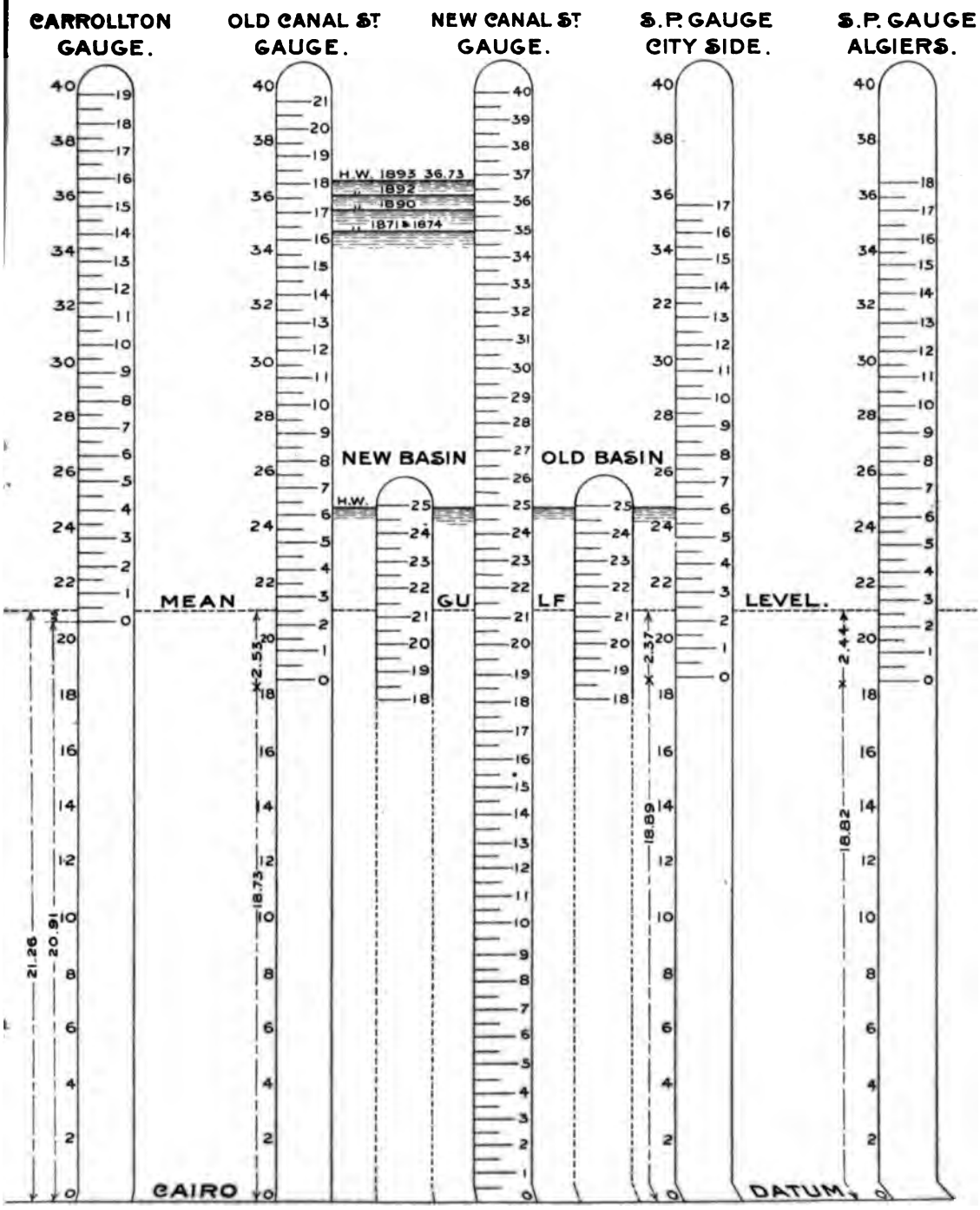
ESTABLISHED FOR RECORDING THE ELEVATION OF

WATER IN RIVER AND LAKE

SHOWING RELATIVE ELEVATION OF THE DIFFERENT GAUGES

AND THE MAXIMUM HEIGHT OF

FLOODS IN RIVER AND STORMS IN LAKE.



NOTE: ALL OF THE GAUGES EXCEPTING THAT MARKED NEW CANAL ST. GAUGE AND THE TWO LAKE GAUGES WERE ESTABLISHED PRIOR TO THE ADOPTION OF ANY STANDARD DATUM.

F. FITZWILLIAM & CO. N.O.

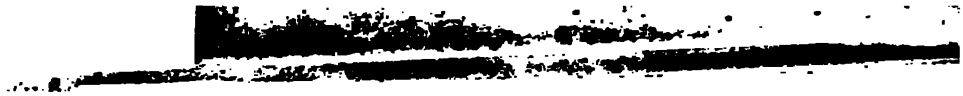


PLATE V

CHARTS-RAIN & DISCHARGE

Board Advisory Board on Drainage

City of New Orleans, La. 1895.

JULY | AUGUST | SEPTEMBER | OCTOBER

PREPARED BY

L. W. BROWN

* CITY ENGINEER *

UNDER THE DIRECTION OF THE

Engineering Committee.

DIAGRAM

PREPARED BY

L. W. HOWK

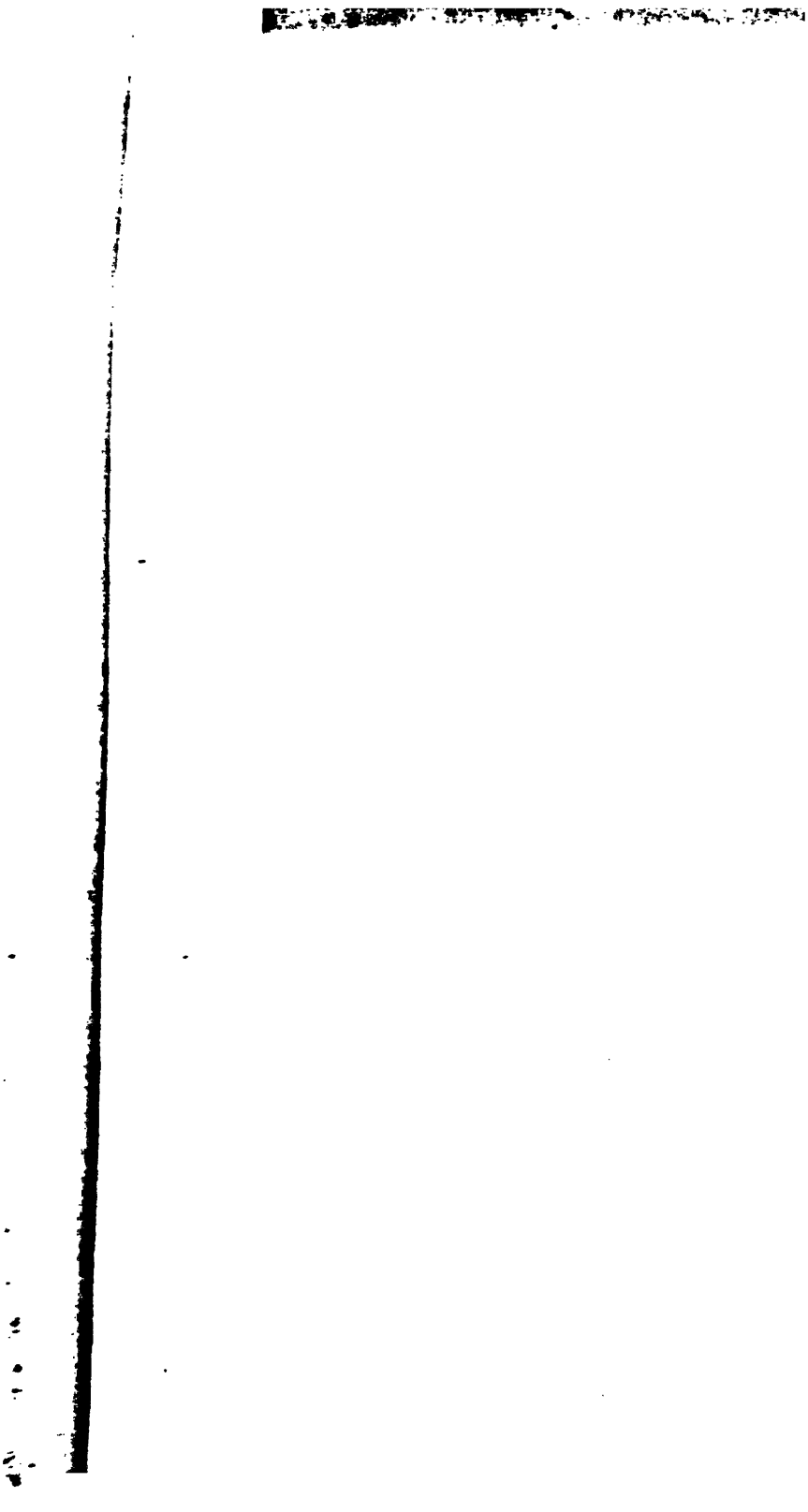
* CITY ENGINEER *

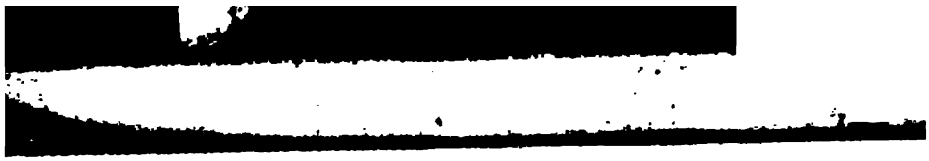
UNDER THE DIRECTION OF THE

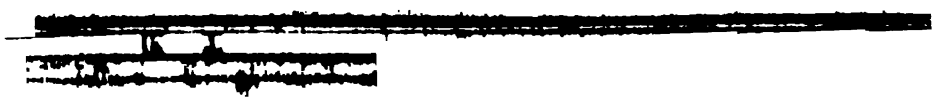
Engineering Committee.

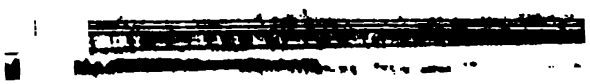
DIAGRAM

[redacted]









PORT OF ADVISORY BOARD ON DRAINAGE
THE CITY OF NEW ORLEANS, LA. 1895.

PLATE

CHART OF GAUGES

ESTABLISHED FOR RECORDING THE ELEVATION OF

WATER IN RIVER AND LAKE

SHOWING RELATIVE ELEVATION OF THE DIFFERENT GAUGES

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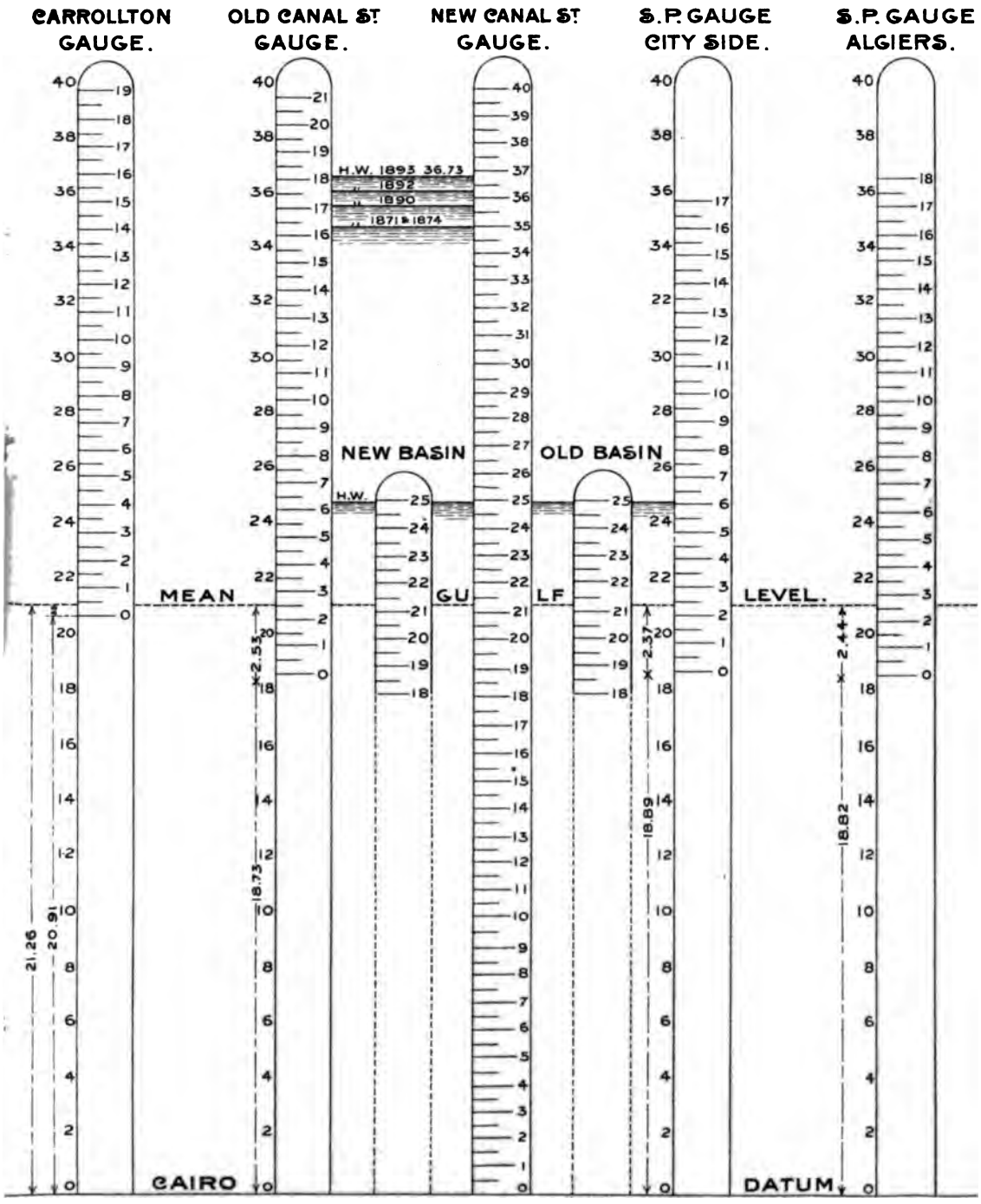

NOTE: ALL OF THE GAUGES EXCEPTING THAT MARKED NEW CANAL ST. GAUGE AND THE TWO LAKE GA